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ARE BIG CITIES REALLY BAD PLACES TO LIVE? IMPROVING QUALITY-OF-LIFE ESTIMATES ACROSS CITIES

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ABSTRACT

The standard revealed-preference hedonic estimate of a city's quality of life is proportional to that city's cost-of-living relative to its wage-level. Adjusting the standard hedonic model to account for federal taxes, non-housing costs, and non-labor income produces quality-of-life estimates different from the existing literature. The adjusted model produces city rankings positively correlated with popular-literature and stated-preference rankings, and predicts how housing costs rise with wage levels, controlling for amenities. Mild seasons, sunshine, and coastal location account for most quality-of-life differences; once these amenities are accounted for, quality of life does not depend on city size, contrary to previous findings.

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1 Introduction

While it has long been established that nominal wage levels increase with city size (e.g. Klarman 1944, Fuchs 1967), it has also long been argued that higher wages in cities compensate workers for the disamenities of urban life, such as crime, congestion, and pollution (Hoch 1972). Nordhaus and Tobin (1972) argue that the loss in quality of life (QOL) from urbanization is a major cost of economic growth, and that this loss should be subtracted from national income growth when measuring gains in economic welfare over time. Elgin et al. (1974) argue that because QOL is low in larger cities, policy-makers should consider "national population redistribution policy aimed at greater population balance," which would depopulate large cities and populate the hinterland.

The hedonic theoretical model of Rosen (1979) – extended by Roback (1982), and Heohn et. al. (1987) – establishes that *real* wages, netting out local cost-of-living, should be used to measure how workers are compensated for urban disamenities. Stated in reverse, a city's QOL can be measured according to how high its cost-of-living is relative to its wage level, as workers sacrifice the consumption of market goods to enjoy non-market amenities purchased indirectly through housing and labor markets. QOL indices based on this hedonic methodology seen in Blomquist et. al. (1988), Gyourko and Tracy (1991), and other research – which all account for cost-of-living through differences in housing costs – are still negatively related with city size (Burnell and Galster 1992).[1]

For those familiar with American cities, the hedonic QOL indices found in this literature often appear counter-intuitive: they do not seem to reflect where individuals would prefer to live if local wage levels or cost-of-living could be ignored. This had led researchers such as Rappaport (2008) to doubt the validity of these estimates, calling them "misplaced." Ranking 185 metropolitan areas in the United States, Berger et. al. (1987) find Pueblo, CO, to be the best city, Binghamton, NY, the 5th best, and Sioux Falls, SD, 34th. On the other hand, San Francisco, CA, is 105th; Portland, OR, 138th; Seattle, WA, 144th; and New York, NY, 165th. Ranking the states, Gabriel et. al. (2003) give the top three places to Wyoming, South Dakota, and Arkansas, but rank Hawaii 35th,

[1]Gyourko, Kahn, and Tracy (1999) and Lambiri et al. (2007) are excellent guides to this literature.

Washington 41st, and California 42nd.[2] These rankings are not positively correlated with QOL rankings found in popular works such as the *Places Rated Almanac* (Savageau 1999), where many large cities score quite favorably in overall "livability" in spite of their high cost-of-living.[3]

As argued here, the hedonic model of Rosen (1979), which has long dominated the QOL literature, produces much more sensible QOL estimates once three adjustments are made. First, cost-of-living measures should incorporate cost differences beyond housing alone. Second, wage differences across cities should be measured after accounting for federal taxes. Third, income from sources other than labor - including income from investments, real estate, or transfers - should be considered in determining a household's buying power, since all income is worth less in more expensive areas.

These three adjustments imply that cost-of-living differences are greater and disposable income differences smaller across cities than previous measures implied. In determining QOL, previous measures put too much weight on wage differences, and too little weight on housing-cost differences. Thus, in large cities, where both wages and cost-of-living are high, they overestimated real incomes and underestimated QOL. The adjustments proposed here put more weight on housing-cost differences and less weight on wage differences, implying that real incomes in large cities are lower, and QOL higher, than previously thought. Interestingly, adjusted QOL estimates no longer fall with city size; in fact, they increase slightly. Furthermore, the adjusted QOL measures produce more believable city rankings: the top two cities in the United States are Honolulu, HI, and Santa Barbara, CA, followed closely by San Francisco. Several large cities such as Boston, Chicago, Los Angeles and New York are above the national average, and the top six states are Hawaii, California, Vermont, Colorado, Montana, and Oregon. The adjusted QOL rankings are positively correlated with the popular rankings found in the *Places Rated Almanac* and with a ranking based on stated

[2]These differences persist when measured at the county level in Blomquist et al. (1988) where suburban Marin County is ranked 142nd (out of 253 counties), even lower than the City and County of San Francisco, ranked 105th.

[3]Burnell and Galster (1992) note that, according to *Places Rated*, QOL peaks at a city size of 4 million, while quality-of-life decreases monotonically using hedonic indices found in Berger et al. (1987). Oppositely, Clark et al. (1992) find that QOL reaches a minimum at 4 million. Their measures are based on nominal, rather than real, wage measures, arguing that this should hold in a monocentric city model with free mobility, where – paradoxically – cities are of fixed size. Heohn et al. (1987), allow city size to be endogenous in a system of monocentric cities, and re-establish the need to use real, rather than nominal, wage differences.

preferences elicited from a telephone survey.

The three proposed adjustments not only produce more believable city rankings, but they also pass an empirical test developed below. Namely, the adjusted model successfully predicts that a one percent increase in the local wage level should increase local housing costs by 1.5 percent when quality-of-life determining amenities are controlled for. On the other hand, the models in the existing literature, including those used recently by Chen and Rosenthal (2008), Deitz and Abel (2009), and Gabriel et al. (2003), predict that this effect should be 3 to 4 percent, and are soundly rejected by the test.

The adjusted QOL model is used to estimate how households value individual amenities. The estimates indicate that households have a substantial willingness-to-pay to live in coastal areas, areas with sunshine, and areas free of excessive temperatures. In fact, a parsimonious model using only four variables for weather and coastal-location explains over 60 percent of the variation in QOL across cities. The positive cross-sectional relationship between QOL and city size is due to the fact that cities are larger in areas with nicer weather and along the coasts, reflecting the location choices of households previously noted by Rappaport and Sachs (2003) and Rappaport (2007). Once these amenities are controlled for, the relationship between QOL and city size is flat, suggesting that increasing urbanization in the United States has no effect on economic welfare. With the bias against larger cities gone, the adjusted model finds that households are willing to pay to live near cultural amenities and to avoid air pollution and urban sprawl. Interestingly, regulations which restrict the use of residential land do not have much of an effect on QOL at the metropolitan level.

Besides fixing the standard economic model of QOL to produce more sensible rankings and amenity valuations, this paper makes a number of other methodological contributions. First, it provides an intuitive graph that explains how wage and housing-cost differentials across cities are converted into QOL estimates. Second, it establishes a single-equation method to infer amenity valuations from the QOL estimates, a method which also reports the proportion of QOL variation explained by a given set of amenities. Discussion in the Appendix establishes theoretically that aggregate QOL estimates are an average of heterogenous household QOL valuations, with each household weighted by their share of national income. It also provides evidence that a log-linear specification, whereby QOL and amenity values are measured in terms of income percentages, rather than in dollar amounts, fits the data better than a linear specification. While the QOL estimates are based on a first-order approximation, estimates based on a second-order approximation to incorporate the progressivity of the tax system and how income and expenditures change across cities are roughly the same. Most interestingly, the Appendix extends the standard model to simultaneously account for taste-heterogeneity and imperfect household mobility using a single parameter. This extension is used to theoretically establish downward-sloping demand curves for city-specific amenities, upward-sloping local labor-supply curves, as well as to model how restrictions on housing supply can raise the cost of housing, but reduce the value of land.

The methods here complement rather than substitute for quasi-experimental estimation methods in work such as Black (1999) and Chay and Greenstone (2005) used to value individual amenities, local-labor market analyses such as Black et al. (2009), or more structural models such as Kennan and Walker (2003) or Bishop (2008), which make additional assumptions to deal with household heterogeneity.. Even consistent estimates of an amenity's effect on wages and housing costs have to combined using proper weights to produce consistent estimates of the value of that amenity. This is particularly true of amenities, such as air quality, that are valued using across-metro as well as within-metro price variation, as the value of these amenities are reflected in wages as well as in housing costs (Albouy 2009b). The value of some amenities, such as good weather — which this analysis implies is highly valued — are nearly impossible to measure using quasi-experimental methods given that areas do not experience sudden and permanent changes in climate. Even with correct estimates of the value of measurable amenities such as crime, air quality, school quality, and other public services, a QOL measure based only on these measures would be incomplete, as many amenities of a city, such as its scenic beauty or downtown charm, are very difficult to measure. The QOL measures here reflect the value of all the amenities a city has to offer, no matter how measurable they are.

2 Model Set-up

To explain how QOL differences are reflected in local wages and prices, this paper uses the canonical model of Rosen (1979) and Roback (1982), developed further by Albouy (2009a, 2009b). The national economy is closed and contains many cities, indexed by j, which trade with each other and share a homogenous population of mobile households. These households consume a traded good, x, with a national price of one, and a non-traded "home" good, y, with local price, p^j. In application, the local price of home goods is equated with the local cost of housing services, and is used to determine the local cost-of-living.

Cities differ in quality of life, Q^j, which is a function of a vector of amenities, $\mathbf{Z}^j$, such as weather, crime, scenic beauty, or cultural opportunities, so that $Q^j = \tilde{Q}(\mathbf{Z}^j)$ for some function $\tilde{Q}$. Firm productivity in either traded or home goods may also vary across cities. However, because households are homogenous, and data on wage levels and cost-of-living are observed, quality-of-life can be estimated without modeling firm behavior, and how wage levels are set, or housing markets, and how housing costs are determined (see Roback 1980 and Albouy 2009b for further detail on production).

Households are assumed to be fully mobile between cities, but they must work in the city in which they live, where they supply a single unit of labor and receive a local wage w^j.[4] Each household holds an identical, fully-diversified share of land and capital in the economy, which pays an income I that is independent of the household's location. This assumption is meant to capture the situation of an average potential migrant, who may own property anywhere in the country, and will likely sell it when moving. Total income, $m^j \equiv I + w^j$, varies across cities only as wages vary.

Out of this income, households pay a federal income tax of $\tau(m - \delta py)$. As explained in Albouy (2009a), federal expenditures are not correlated with federal taxes, and most federal public goods, such as national defense, benefit households across areas fairly equally. Therefore, differences in the disposable income of households across cities should be measured after federal

[4] Roback (1980) models elastic labor supply, and finds it has no first-order effects on QOL estimates.

taxes. Tax deductions for expenditures such as housing and local government-provided goods are modeled through the deduction parameter, $\delta \geq 0$, times the expenditure level on home goods.[5]

Household preferences are modeled by a utility function, $U(x, y; Q)$, that is quasi-concave, and increasing in x, y, and Q. The after-tax net expenditure necessary to obtain utility u, given local prices, p^j,w^j, QOL, Q^j, and tax schedule, τ, can be written as

$$e(p^j, w^j, \tau, \delta, u; Q^j) \equiv \min_{x,y} \left\{ x + p^j y - w^j - I + \tau(w^j + I - \delta p y) : U\left(x, y; Q^j\right) \geq u \right\}$$

Since households are fully mobile, their utility must be the same across all inhabited cities. Therefore, in an equilibrium across all inhabited cities, no household requires any additional compensation to live in its city of residence, given the income it already earns

$$e(p^j, w^j, \tau, \delta, \bar{u}; Q^j) = 0 \tag{1}$$

where $\bar{u}$ is the national level of utility. This mobility condition need not apply to all households, but only a sufficiently large subset of mobile "marginal" households.[6] It is the set of marginal households that determines the QOL values observed, just as marginal consumers determine prices in other competitive markets.

To see how wage and prices should vary with QOL, fully differentiate equation (1) to get

$$\frac{\partial e}{\partial p} dp^j + \frac{\partial e}{\partial w} dw^j + \frac{\partial e}{\partial Q} dQ^j = 0$$

[5] The local public sector does not need to be explicitly modeled. If local government goods are provided efficiently, as in the Tiebout (1956) model, these goods can be treated as consumption goods, part traded and part non-traded. Efficiency differences in local public sectors may be captured by differences in Q (Gyourko and Tracy 1989).

[6] It is a strong assumption to assume that markets are all in equilibrium. Greenwood et al. (1991) estimate equilibrium real wages separately from actual real wages, and find that in only 7 out of 51 cases are the two the statistically different at the 90 percent significance level (Hunt 1991). Interestingly, the QOL estimates from Greenwood et al. (1991), which depend on migration patterns, as well as real wages, are not adjusted for federal taxes or non-labor income, and are higher for Arkansas, Mississippi, and South Dakota than they are for Hawaii and California. In an out-of-equilibrium setting, in-migration should occur in cities where QOL is high relative to the cost-of-living net of local income differences. Other things equal, cities experiencing above-average levels of in-migration may have higher levels of QOL than the estimates here suggest. However, population movements are also influenced greatly by productivity changes in traded or home goods, which affect the availability of local jobs and housing. In-migration may then reflect workers moving to take advantage of available jobs or housing, rather than higher QOL.

This first-order approximation is taken around a city with average prices and QOL, so that we ignore superscripts j on the derivatives, which are evaluated at the national average $p, w,$and Q. Applying Shepard's Lemma and rearranging this formula

$$(1-\delta\tau')\cdot y\cdot dp^j-(1-\tau')\cdot dw^j=p_Q\cdot dQ^j \tag{2}$$

where τ' is the marginal tax rate on income and $p_Q \equiv -\partial e/\partial Q = (\partial U/\partial Q)/(\partial U/\partial x)$ is the willingness-to-pay to increase QOL by one unit. Log-linearizing this formula, so that $\hat{p}^j \equiv dp^j/p$, $\hat{w}^j \equiv dw^j/w$ and, normalizing appropriately, $\hat{Q}^j \equiv p_Q \cdot dQ^j/m$, it follows

$$(1-\delta\tau')\cdot s_y\hat{p}^j-(1-\tau')\,s_w\hat{w}^j=\hat{Q}^j \tag{3}$$

where $s_y \equiv py/m$ is the share of income spent on home goods and $s_w \equiv w/m$ is the share of income received from labor. In percentage terms, $s_y\hat{p}^j$ represents how high cost-of-living is in city j relative to the national average, while $s_w\hat{w}^j$ represents how high nominal income is relative to the national average. $(1-\tau')s_w\hat{w}^j$ gives the net-of-tax difference in nominal income, while $(1-\delta\tau')$ gives the net-of-deduction difference in cost-of-living. Thus (3) equates local QOL with the degree to which local cost-of-living exceeds nominal income levels, adjusting for taxes, or how low after-tax real incomes are relative to the national average. The resulting QOL measure is cardinal, and represents what percent of total income households are willing to sacrifice to live in city j rather than an average city. In cities with below-average QOL, in which case $-\hat{Q}^j$ represents how much households need to be paid to live in city j, rather than a city with average QOL.[7]

[7]Equation (3) is based on a first-order approximation of the mobility condition. As shown in Appendix A.3, a second-order approximation has only a minute impact on QOL estimates. Furthermore, Davis and Ortalo-Magne (2007) provide empirical evidence that s_{hous} is fairly constant across time and metropolitan areas, justifying the use of a single number for s_y.

3 Choosing the Right Parameters

Equation (3) makes it clear that measures of QOL depend heavily on the parameters s_y, s_w, τ', and δ used to weight the wage differential, $\hat{w}^j$, and the home-good price differential, $\hat{p}^j$. Most previous studies — this includes Berger et al. (1987), Blomquist et al. (1988), Beeson and Eberts (1989), Gyourko and Tracy (1991), Gabriel and Rosenthal (2004), and Davis and Orthalo-Magne (2007) — interpret home goods to include housing services alone, and choose an s_y of approximately 25 percent . Furthermore, they do not adjust for federal taxes, so that τ' is effectively set to zero, and treat labor income so that s_w is effectively set to one. Applying these choices to equation (3),

$$\hat{Q}^j = 0.25\hat{p}^j - \hat{w}^j$$

which implies that a one-percent lower wage level is weighted four times more in calculating QOL than a one-percent higher housing cost.[8] A more realistic parametrization, argued for here, accounts for non-housing differences in cost-of-living, federal taxes, and non-labor income is $s_y = 0.36, s_w = 0.75$, $\tau' = 0.32$ and $\delta = 0.31$. These three adjustments all place more weight on housing costs relative to wages. This parametrization weights a one-percent lower wage level only one-and-a-half times as much as a one-percent higher housing cost:

$$\hat{Q}^j = 0.33\hat{p}^j - 0.51\hat{w}^j$$

All three adjustments are discussed in greater detail below.

Households are aggregated by weighting each by their respective income. As discussed in Appendix A.1, this produces the most sensible results when we wish to determine how QOL differences across cities affect wages and housing costs. Thus, the three parameters and the calculated wage and cost differentials should be based on income-weighted averages of households.

[8]More specifically the relative weight on wages is 3.61 in Blomquist et al. (1988), 3.7 in Beeson and Eberts (1989), 4.82 in Gyourko and Tracy (1991), 3.72 in Gabriel et al. (2003), 4 in Davis and Orthalo-Magne (2007), and 2.87 in Chen and Rosenthal (2008). The latter is closest to the study here.

3.1 The Expenditure Share for Home Goods

In the previous literature – with the exception of Gabriel et al. (2003) and Shapiro (2006) – the cost-of-living differential $s_y\hat{p}^j$ is limited to cost differences in shelter and utilities, with an expenditure share, s_y, between 18 and 28 percent used to weight housing-cost differentials across cities.[9] Yet, cost differences for non-housing goods also affect household consumption and utility, and therefore need to be included. Thus, the cost-of-living differential is recast in terms of housing and non-housing goods, rather than in terms of home and traded goods:

$$s_y\hat{p}^j = s_{hous}\hat{p}^j_{hous} + s_{oth}\hat{p}^j_{oth} \tag{4}$$

s_{hous} and s_{oth} are the expenditure shares for housing and for other goods, and $\hat{p}_{hous}$ and $\hat{p}_{oth}$ are the cost differentials for housing and for other goods. Income not spent on goods is saved or paid in taxes, including Social Security. Expenditure shares are taken from the Consumer Expenditure Survey (CEX), which reports the share of income spent on shelter and utilities, s_{hous}, is 0.22, and the share of income spent on other goods, s_{oth} is 0.56 (Bureau of Labor Statistics 2002).

While data on regional differences in housing costs, used for $\hat{p}_{hous}$, are of good quality, data on regional differences in the cost of other goods, used for $\hat{p}_{oth}$, are limited. The most commonly used data come from the ACCRA Cost-of-Living Index, which measures price differences across expenditure categories, and is meant to be used to measure cost-of-living differences for working professionals. There are several problems with this data, discussed by Koo et al. (2000): it covers a limited number of goods, is collected by volunteers, and may exaggerate housing-cost differences across areas. A more practical problem here is that these data are not available at the metropolitan level and they cover only a limited number of areas.

Rather than use the ACCRA data directly – as in Gabriel et al. (2003) – I use these data to infer how housing costs predict other prices, so that housing costs alone may be used to infer cost-of-

[9] The term "housing cost" is used here to refer to the cost of housing services for households. This refers to rent or, for homeowners, an imputed rent based on housing prices, which in standard practice includes the cost of utilities. This practice is followed here since contract rents often include utilities, which make it difficult to disentangle utilities.

living differences. Writing the regression formula for non-housing costs as a function of housing costs $\hat{p}^j_{oth} = b\hat{p}^j_{hous} + e^j$, the cost-of-living equation (4) becomes

$$s_y\hat{p}^j = (s_{hous} + s_{oth}b)\hat{p}^j_{hous} + s_{oth}e^j \quad (5)$$

Indices for housing costs and other costs are calculated from the ACCRA data in 2004, reweighted using expenditure weights from the CEX.[10] A regression using this data in natural logarithms reveals that housing costs predict other prices well:

$$\ln p^j_{oth} = \underset{(0.043)}{3.57} + \underset{(0.012)}{0.263} \ln p_{hous} + e^j \qquad R^2 = 0.66$$

With $s_{hous} = 0.22$, $s_{oth} = 0.56$, and the estimated coefficient of $b = 0.26$ in (5), the cost-of-living differential based on the housing-cost differential is $0.36\hat{p}^j_{hous}$. Thus if housing costs are used to measure $\hat{p}^j$ in (3), then this implies an effective share of $s_y = 0.36$. On average, goods other than housing account for $(s_{oth}b)/s_y = 41$ percent of the cost-of-living differences in this formulation. Assuming no measurement error, the $R^2 = 0.66$ implies that only a third of the variance in non-housing costs is not predicted by housing costs, and therefore only 14 percent of all cost-of-living variation is lost from using the proposed approximation. Given that the ACCRA data do not cover many cities and are somewhat noisy, using this approximation is a reasonable method of calculating cost-of-living differences across cities. The approximation also implies that previous studies, which used smaller values of s_y, systematically underestimated cost-of-living differences across cities.[11]

[10] Results using 1999 ACCRA data are almost identical.

Theoretically, this methodology can be justified by assuming that households consume a housing good, y_{hous}, and a non-housing good, x_{oth}, according to the utility function $U = Q\left(y_{hous}\right)^{s_{hous}}\left(x_{oth}\right)^{s_{oth}}$. This non-housing good is produced from the traded good x and the remainder of the home good not devoted to housing, $y_{oth} = y - y_{hous}$, according to the production function $x_{oth} = (x)^{1-b}\left(y_{oth}\right)^{b}$.

[11] Gabriel et al. (2003) use the ACCRA data directly. Because the data do not cover enough cities, the authors cannot create individual city rankings, and instead perform their analysis by state. They claim that cost-of-living differences within state should be small relative to differences between states, although this may be problematic in large states such as California, Illinois, Michigan, and New York. According to my calculations, the authors used an effective $s_{hous} = 0.22$ and $s_{oth} = 0.38$, leading to an effective s_y of approximately 0.27, quite similar to the other

3.2 The Share of Income from Labor

Conceptually, the term s_w in equation (3) needs to account for how much a household's income will change percentage-wise if the household moves to a city with a different wage level. A value of $s_w = 1$ ignores a number of income sources, such as from investments in capital or real estate, or intrafamily transfers, sources whose value do not increase when households switch to different local labor markets. For example, a household that owns a house will typically sell it before moving across cities; in the new city they will purchase a new house reflected in the price p^j. Previous QOL studies, e.g. Blomquist et al. (1988) or Chen and Rosenthal (2008), have typically determined the weight to put on the wage differential, $\hat{w}^j$, by assuming that each household supplies one full-time/full-year worker. The average wage income of such a worker is divided by average household rent to estimate s_w/s_y, typically producing values between 3.5 and 4.5, which then determines how much weight is put on wages relative to rents. This ad hoc procedure not only assumes homogenous household types, but proves to be inaccurate.

Households vary in the amount and share of income that they earn from labor, however on average this share appears to be 75 percent (Krueger 1999). Accordingly, an average household moving to a city with 10 percent higher wages sees its before-tax nominal income rise by 7.5 percent. As shown in Appendix A.1, using this aggregate weight means that the QOL estimate will reflect the weighted average of the QOL valuations of different households, such as those with differing numbers of workers, as well as retired households, each according to their income level, if sorting issues are not too severe. Sorting of this kind is greatly reduced if retirees decide to locate close to their children, especially if families share income. Retirees and their working children

literature.

Shapiro (2006) does not use the ACCRA data directly, but does use it to compute his effective s_y. He regresses the total ACCRA composite index on the index for housing alone, finding a slope of 0.34, which is used for s_y in conjunction with housing prices. This is similar to the methodology used here, except that I provide a more explicit formula and use weights taken from the CEX rather than the weights provided by ACCRA. This method is similar in nature to cost-of-living indices being developed by Carrillo et al. (2009).

Moretti (2008) runs a regression similar to (5) across cities over time using local Consumer Price Index data from major cities,supplied by the Bureau of Labor Statistics. He estimates a larger value of $b = 0.35$. Moretti's estimate is somewhat larger than the one here mainly because the CPI expenditure shares do not include income saved or paid in taxes. Once these expenditures are taken into account, the adjusted $b = 0.25$, which is very close to the estimate used here of 0.26.

who locate together act like a family "dynasty" as in Barro (1974).

The figure of 75 percent is corroborated by survey data on individuals' net worth and income in the Survey of Consumer Finances (SCF) in 2001. The average net worth of households is $341,300, 6.9 times the average household income of $49,500. At a modest real interest rate of 3.5 percent, the flow value of this worth is $11,946, or 24.1 percent of income. Using the figure of $s_w = 0.75$ and $s_y = 0.36$ from above, the relative weight that should be put on wages relative to housing costs in calculating QOL is $s_w/s_y = 2.08$ before accounting for federal taxes. The smallest relative weight in the QOL literature, by Chen and Rosenthal (2008), is still much larger at 2.86.

3.3 Federal Taxes and Deductions

Federal taxes reduce the disposable income households gain from moving to a city offering higher wages, thereby narrowing disposable income differences across cities. A wage differential of $\hat{w}^j$ that a worker gains from moving to city j is accompanied by the burden of the tax differential of $\tau'\hat{w}^j$, a burden which comes with no additional benefits.

To calculate the marginal tax rate that workers face on their labor income, a base federal income tax rate is taken from TAXSIM (Feenberg and Coutts 1993), which for 2000 calculates a marginal rate of 25.1 percent. This tax rate applies to the average dollar earned from labor, or equivalently, the average household weighted by income. Federal payroll taxes paid on the employee side are added to this rate, including 1.45 percent for Medicare (Congressional Budget Office 2005) and half of the 6.2 percent tax for Social Security (OASDI), based on the simulation in Boskin et al. (1987, Table 4). This increases the effective federal tax rate to 29.6 percent.[12]

As housing is a major determinant of cost-of-living, it is worth considering the tax advantages to owner-occupied housing that the federal tax code provides (see Rosen 1985). As shown in

[12] In a sense, the term s_w is a product of the log-linearization. It disappears if s_y expresses the share of *labor*, not total, income spent on home goods, which in this model is s_y/s_w. According to the parametrization here, this should be 48 percent. Chen and Rosenthal (2008), use a s_y/s_w ratio of 0.35 and neglect federal taxes. Interestingly, Chen and Rosenthal differ from the previous literature in that their best-ranked cities are similar to the ones here, with California topping the list, although most other large cities such as New York and Portland typically rank poorly.

Albouy (2009a), these tax advantages, modeled as a tax deduction for home goods, serve to reduce tax burdens in high-cost areas. Determining the deduction level requires taking into account the fact that many households do not itemize deductions. According to the Statistics on Income, although only 33 percent of tax returns itemize, they account for 67 percent of reported Adjusted Gross Income (AGI). Since the income-weighted share is what matters, 67 percent is multiplied by the effective tax reduction given in TAXSIM, in 2000 of 21.6 percent. Thus, on average these deductions reduce the effective price of eligible goods by 14.5 percent. Since eligible goods only include housing, this deduction applies to only 59 percent of home goods. Multiplying 14.5 percent times 59 percent gives an effective price reduction of 8.6 percent for home goods. Divided by a federal tax rate of 29.6 percent, this produces a federal deduction level of 29 percent.[13]

Differences in within-state tax burdens are worth considering as wages and prices can often vary significantly within a state, while state services largely do not. State-tax differentials are computed by multiplying state tax and deduction rates by the wage and price differentials within state. These state tax rates incorporate income and sales taxes since sales taxes reduce the buying power of labor income. The total-tax differential for a city is the sum of the federal-tax differential and the state-tax differential. At the state level, effective marginal tax rate on wages by 6.2 percentage points, on average, ranging from 0 points in Alaska to 8.8 percent in Minnesota. However, wage differences within state are only 44 percent as large, on average, as wage differences within the entire country. Thus, total tax differences may be approximated by increasing the federal marginal tax rate by $6.2 \times 0.44 = 2.7$ points to $\tau = 0.323$, although state-tax differentials below are calculated exactly using equation (6). At the state level, deductions for income taxes are calculated in an equivalent way using TAXSIM data, and also account for how housing expenditures are deducted from the sales tax. State adjustments raise the effective deduction level of $\delta = 0.31$.[14]

[13] A move from a low-wage city to a high-wage city could potentially increase a household's marginal tax rate. A preliminary adjustment for progressivity used in the second-order approximations in Appendix A.3, suggests that the impact of progressive taxes is very small.

[14] Quality of life is computed using the augmented formula

$$\hat{Q}^j = (1 - \delta\tau') \cdot s_y \hat{p}^j - (1 - \tau')\, s_w \hat{w}^j + \tau'_S [s_w(\hat{w}^j - \hat{w}^S) - \delta_S s_y (\hat{p}^j - \hat{p}^S)] \tag{6}$$

where τ'_S and δ_S are are marginal tax and deduction rates at the state-level, net of federal deductions, and $\hat{w}^S$ and $\hat{p}^S$

Summing up, accounting for federal taxes and deductions lowers the wage/housing-cost weight even further from 2.08 to 1.54.[15]

4 Wage and Housing-Cost Differences

4.1 Data

Wage and housing-cost differentials are estimated using the 5 percent sample of U.S. Census data from the 2000 Integrated Public Use Microdata Series (IPUMS). Cities are defined at the Metropolitan Statistical Area (MSA) level using 1999 OMB definitions. A consolidated MSA is treated as a single city (e.g. "San Francisco" includes Oakland and San Jose) so that commuting patterns can be ignored. Non-metropolitan areas within each state are also grouped together as a single "city." This classification produces a total of 290 "cities" of which 241 are actual metropolitan areas and 49 are non-metropolitan areas of states. More details are provided in Appendix C.

The 5 percent Census sample is used in its entirety for the first time in this type of study, guaranteeing the precision of the wage and price and differentials: the average city has 14,199 wage and 11,119 housing-price observations; the smallest city has 1093 wage and 817 housing-price observations.

Data on amenities are taken from various sources, and are described in greater detail in Appendix C. Amenities are divided into two categories. The first are natural site-specific characteristics such as climate and geography, which are exogenous to a city's inhabitants. These include inches of precipitation, heating degree days and cooling degree days per year, sunshine as a fraction of

are the differentials for state S as a whole relative to the entire country.

State income tax rates from 2000 are taken from TAXSIM, which, per dollar, fall at an average marginal rate of 4.5 percent. State sales tax data in 2000 is taken from the Tax Policy Center, originally supplied by the Federation of Tax Administrators. The average state sales tax rate is 5.2 percent. Sales tax rates are reduced by 10 percent to accomodate untaxed goods and services other than food or housing (Feenberg et al. 1997), and by another 8 percent in states that exempt groceries, equal to its share of expenditures.

[15]There are a number of complications with all of the parameter choices since we need to know the parameters for the set of potential movers who determine how quality-of-life in different cities is valued. These movers may be younger and more educated than the households represented by the parameters.

the possible total, and whether a metropolitan area is adjacent to a coast, either on the sea or the Great Lakes. The second category of amenities contains those that depend on a city's population. These amenities are measured using violent crimes per capita, the median Air Quality Index over the year, restaurants and bars per capita, the Arts & Culture Index from *Places Rated*, an index of residential land use regulation, an index of urban sprawl, local expenditures net of local taxes, and the number of federal dollars spent locally, with the last two expressed as a fraction of income.

4.2 Wage and Housing-Cost Regressions

Inter-urban wage differentials are calculated from the logarithm of hourly wages for full-time workers, ages 25 to 55. In keeping with the methodology of Rosen (1979), these differentials control for skill differences across cities to provide a meaningful analogue to the representative worker in the model. Adopting the variant of this methodology by Gabriel et al. (2003), log wages are regressed on city-indicators (μ^j) and on extensive controls (X_i^{wj}) – interacted with gender – education, experience, race, occupation, industry, and veteran, marital, and immigrant status, in an equation of the form

$$\log w_i^j = X_i^{wj}\beta^w + \mu^j + e_i^{wj} \tag{7}$$

The coefficients μ^j are used as the wage differentials, and are interpreted as the causal effect of city j's characteristics on a workers wages.

To identify these differentials correctly, workers cannot sort across cities according to their unobserved skills, an assumption which is unlikely to hold completely. Glaeser and Maré (2001) argue that the urban-rural wage gap is largely unaffected by selection bias, with no more than a third of the gap being due to unobserved selection. If there is unobserved selection in this direction, then measured wage differentials in larger cities are biased upwards, causing QOL in these cities to be underestimated. It is also possible that the estimated wage differentials are too small as some of the worker characteristics controlled for, such as occupation or industry, could depend on where the worker locates. In practice these additional controls do not have a large effect on the estimates.[16]

Both housing values and gross rents, including utilities, are used to calculate housing-cost differentials. To be consistent with previous studies, imputed rents are converted from housing values using a discount rate of 7.85 percent (Peiser and Smith 1985), to which utility costs are added: this makes imputed rents comparable to the gross rents available for rental units. To avoid measurement error from imperfect recall or rent control, the sample includes only units that were acquired in the last ten years. Housing-cost differentials are calculated in a manner similar to wage differentials, using a regression of gross rents on flexible controls (X_i^{pj}) - interacted with tenure - for size, rooms, acreage, commercial use, kitchen and plumbing facilities, type and age of building, and the number of residents per room.

$$\log p_i^j = X_i^{pj}\beta^p + \nu^j + e_i^{pj} \tag{8}$$

The coefficients ν^j are used as the housing-cost differentials, and is interpreted to measure how much costlier a standard unit of housing in city j is relative to the national average. Proper identification of housing-cost differentials requires that average unobserved housing quality does not vary systematically across cities.[17]

[16]Adjustment for unionization rates was also considered based on data from Hirsch and Macpherson (2003). MSA unionization rates in 2000 range from 34.4 percent MN in Duluth to 0.6 percent in Hickory, NC. Lewis (1986) concludes that unions raise wages by approximately 15 percent. If somehow these higher wages are not absorbed by a higher cost-of-living – perhaps through restricted entry into union jobs – then this could cause after-tax real incomes to be up to 2.5 percent higher in Duluth relative to Hickory for reasons independent of local amenities. Thus, omitting unionization could cause quality-of-life to be underestimated in highly unionized areas. Adjusted estimates quality-of-life estimates were calculated using an adjustment for unionization: the resulting measures were only slightly different than the ones reported. Since it is unclear whether or not unions actually raise wages (Dinardo and Lee 2004), and whether or not higher wages from unions are absorbed by cost-of-living, the estimates are not adjusted for unionization.

[17]This issue may not be grave as Malpezzi et. al. (1998) determine that housing-price indices derived from the Census in this way perform as well or better than most other indices.

There is also the question of whether housing prices reflect differences in housing costs as accurately as rents do. This issue is addressed in Appendix C.2.

5 Quality-of-Life Estimates and Rankings

5.1 Calculating and Visualizing Quality-of-Life Estimates

With these wage and housing-cost differentials and the chosen parameters, QOL can be estimated directly from (3). Figure 1 graphs the wage and cost differentials for different cities, with $\hat{w}$ on the horizontal axis and $\hat{p}$ on the vertical axis. This figure can be used to see how QOL is estimated by rewriting (3) as

$$\hat{p}^j = \frac{(1-\tau')\,s_w}{(1-\delta\tau')s_y}\hat{w}^j + \frac{1}{s_y}\hat{Q}^j \tag{9}$$

This is an equation for the mobility condition for households for a given QOL differential, $\hat{Q}^j$, in terms of $\hat{w}^j$, which has a slope given by the wage/housing-cost weight. The solid line in Figure 1 corresponds to the mobility condition with $\hat{Q}^j = 0$: it passes through the origin and has a slope equal to 1.54. Along this line prices rise with wage levels in the right proportion so that after-tax real incomes remain constant, as does the inferred QOL. Cities above this line have a high cost-of-living relative to local income levels, and thus a higher inferred QOL, equal to s_y times the vertical distance from the solid line. The opposite is true of cities below the line.

Table 1 lists wage, housing-cost, and quality-of-life differentials for several metropolitan areas, the nine Census divisions, and for metropolitan areas of different population sizes. Appendix Table A1 presents estimates for all 241 metro areas and 49 non-metropolitan areas of states; Appendix Table A2 presents estimates for all of the states. These estimates are favorable to locations near the Pacific Coast: Honolulu is first, and Santa Barbara is a close second. Other cities in the West do well: San Francisco (#6) and San Diego (#7) are both in the top 10; Los Angeles is #17; Seattle, Denver, and Portland are all in the top 40. On the East Coast, Naples, FL ranks highest (#8), Miami (#34) and Boston (#35) are the best large cities, and New York is #43. Cities in the Midwest and in the South generally fare poorly, although New Orleans and Chicago are above average.

QOL estimates using the unadjusted parametrization, typical of the previous literature, may be visualized using the dashed line in Figure 1. This line has a slope of 4, implying that housing costs in this parametrization must rise more quickly with wages to keep households indifferent. Unlike the solid line, the dashed line passes under most of the smaller cities in the sample, giving them a higher inferred QOL than in the adjusted case, and above most of the larger cities, giving them a lower inferred QOL.

The adjusted QOL, using the favored parametrization, are graphed against the unadjusted QOL estimates in Figure 2. Cities above the diagonal have higher adjusted estimates than unadjusted estimates. The choice of the parametrization is obviously important as these estimates are substantially different. When cities are weighted according to their population, the correlation between the adjusted and unadjusted QOL estimates is actually negative.[18]

5.2 Quality of Life and City Size

The largest discrepancies between adjusted and unadjusted estimates occur in large cities, where wages and costs are high, and smaller cities, where the opposite is true. The relationship between QOL and city size is shown in Figure 3a for adjusted estimates and 3b for unadjusted estimates. While the adjusted estimates indicate a small positive relationship between population size and QOL, the unadjusted estimates indicate a starkly negative relationship.[19]

Because of agglomeration economies, worker productivity increases with city size, so that larger cities pay higher wages, which, holding QOL constant, are neutralized via higher costs-of-living. As seen in (9), workers bid up the cost-of-living in a city either to enjoy its amenities or to be close to a well-paying job. The unadjusted parametrization overstates the income gains that households receive from moving to larger cities, and understates the higher cost-of-living they endure. This causes real incomes to be overestimated and QOL to be underestimated in

[18] In essence, most previous studies used the projection of the unadjusted QOL estimates onto the space of individual amenities used in their regression analysis, a procedure which may have mitigated some of the problems with the unadjusted parametrization. Beeson and Eberts (1989) were the first authors to use the aggregate QOL measure seen here, although their study was limited to the 35 largest cities, largely obscuring the implied negative relationship between QOL and city size. My analysis with 1980 Census data – the same data used by Blomquist et al. (1988), Beeson and Eberts (1989), and Gyourko and Tracy (1991) – suggests that adjusted and unadjusted QOL estimates are more positively correlated in 1980 than in 2000, although the differences in 1980 are still very substantial.

[19] Adjusted QOL estimates from 1980 still reveal a positive, albeit statistically insignificant, relationship between QOL and city size. Whether this is because urban disamenities, such as pollution, were more severe in 1980 deserves further investigation.

larger cities. Explained in reverse, this logic also explains why real incomes were previously underestimated, and QOL overestimated, in smaller cities with lower wages and costs-of-living.

5.3 An Empirical Test of the Mobility-Condition Slope

The dotted line in Figure 1 shows a regression line of housing-cost differentials predicted by wage differentials. Controlling for amenities, the slope of this line can be used to test the parametrization used to measure QOL. The difference between the regression line and the calibrated mobility condition implies a statistical relationship between QOL and wage levels. The linear projection of QOL on wages may be written $\hat{Q}^j = b_Q \hat{w}^j + \eta^j$, where by construction $E\left[\eta^j|\hat{w}^j\right] = 0$. The expectation of $\hat{p}^j$ conditional on $\hat{w}^j$ in equation (9) is then

$$E\left[\hat{p}^j|\hat{w}^j\right] = \left[\frac{(1-\tau')\, s_w}{(1-\delta\tau')s_y} + \frac{b_Q}{s_y}\right]\hat{w}^j \equiv b_w \hat{w}^j$$

The slope of the regression line in Figure 1, reported in Table 2, is the slope of the mobility condition under the true parametrization, whatever it truly is, *plus* a term which depends on the correlation of QOL with wage levels. If wages and QOL are uncorrelated, then $b_Q = 0$, and the mobility condition is given by the regression line, as posited but not theoretically justified by Glaeser, Kolko, and Saiz (2002). If instead the correct parametrization is known, then b_Q/s_y can be estimated by subtracting $(1-\tau')\, s_w/[(1-\delta\tau')/s_y]$ from b_w; estimates of b_Q/s_y are reported in the bottom row of Table 2. The adjusted parametrization implies a positive relationship between nominal wage levels and QOL; the unadjusted parametrization implies a highly negative one.

The parametrization test is inspired by equation (9), which implies that if actual QOL, or all of the amenities that affect it, could be perfectly observed and included in the regression of $\hat{p}^j$ on $\hat{w}^j$ as control variables, then b_w would provide an unbiased estimate of the true value of $(1-\tau')\, s_w/[(1-\delta\tau')/s_y]$. Since actual QOL cannot be observed directly, a second-best approach is to include amenities that are likely to affect QOL as control variables in a regression of of $\hat{p}^j$ on $\hat{w}^j$ and to test whether the estimated b_w is significantly different from the slope implied by the parametrization.

The results of this procedure are shown in columns 3 and 4 of Table 2. The estimates of b_w are close to the slope of the mobility condition implied by the adjusted parametrization, lending support to the resulting QOL estimates. On the other hand, this test soundly rejects the unadjusted parametrization, which can only be correct if the QOL residual not explained by the included amenities is very negatively correlated with wage levels.[20]

5.4 Relationship with Popular, Stated-Preference, and Previous Hedonic Rankings

Another check on the validity of the hedonic QOL estimates is to consider how they correlate with other estimates of QOL based on non-hedonic methods. One measure is a popular ranking from the *Places Rated Almanac* by Savageau (1999). As explained in Becker et al. (1992), *Places Rated* determines its overall livability index by ranking cities along nine dimensions: climate, crime, health care, transportation, education, arts and culture, recreation, housing costs, and job outlook. These nine rankings are then averaged geometrically to determine an overall "livability" ranking. The choices made to compute these rankings involve a number of subjective decisions, leading many to question their results. Yet at the same time the final results have a certain plausibility that help account for their popularity. Previous hedonic QOL estimates are generally uncorrelated with these rankings, casting doubt on both methodologies.

As seen in the first row of Table 3, the correlation between the adjusted hedonic ranking and *Places Rated* QOL rankings is positive, while the correlation with the unadjusted hedonic ranking is negative. One issue with comparing these rankings is that *Places Rated* incorporates cost-of-living and job-market components in its ranking, elements which do not belong in the hedonic QOL ranking since these components are used to infer the value of the other amenities in the city. The two methodologies are quite different: the hedonic method assumes that in equilibrium, no city is better than any other once cost-of-living and labor-market opportunities are accounted for;

[20]It is worth noting that the parameters were intially chosen in order to predict the effect of federal taxes in Albouy (2009a), and not to estimate QOL. Also, most of the amenity measures in the regression were chosen prior to the development of this test. Thus, this test does not suffer from conventional pre-test bias.

the *Places Rated* method attempts to find the cities which offer the most valuable amenities at the lowest cost, producing recommendations similar to the "Best Value" recommendations seen in *Consumer Reports*. The *Places Rated* rankings can be recalculated by removing the housing cost and job outlook components. As seen the second row of Table 3, these recalculated *Places Rated* rankings are more positively correlated with the adjusted hedonic ranking and more negatively correlated with the unadjusted ranking.[21]

Another measure of QOL is based on stated preferences from the Pew Research Center by Taylor et al. (2009). In a telephone survey respondents were named 10 cities in random order and asked "As I read through the following places, just tell me your first reaction::would you want to live in this city or its surrounding metropolitan area or NOT want to live there?" The percent of "yes" and "no" responses are used to construct a ranking of 28 cities. This ranking has several shortcomings for purposes here: they are from 2008, respondents were not told to ignore labor-market opportunities or cost-of-living, and all of the listed cities are fairly large. Nonetheless, the answers are likely to reflect cities that respondents consider to have an attractive QOL. As seen in Panel B of Table 3, rankings based on this stated-preference measure are positively correlated with both QOL rankings, albeit more strongly with the adjusted ranking.

It is also worth noting how the adjusted and unadjusted QOL estimates compare with the QOL estimates based on the same basic method in the previous literature. Panel C compares state-level QOL estimates with those in Gabriel et al. (2003) for 1980 and 1990, who use an effective wage/housing-cost weight of 3.72, taking into account their use of ACCRA data to deal with non-housing costs.[22] These estimates are only weakly correlated with the adjusted estimates, but are strongly correlated with the unadjusted estimates, as they are based on roughly the same formula and as the estimates do not change much from decade to decade.. Panel D compares metro-level QOL estimates with those in Chen and Rosenthal (2008), which as they use a wage/housing cost weight of 2.86, are the closest QOL in the literature to the ones presented here. The Chen and

[21] An additional support for the adjusted QOL estimates is provided by Carlino and Saiz (2008), who find that the adjusted QOL estimates are positively correlated with the number of tourist visits in a city.

[22] Note that Shapiro (2006) also takes into account non-housing costs, but never presents his QOL rankings.

Rosenthal estimates are strongly correlated with the QOL estimates here, but are even slightly more positively correlated with the unadjusted estimates, especially when non-metro areas are included. Although the Chen and Rosenthal estimates appear to the best in the literature so far, their wage/housing cost weight of 2.86 is still firmly rejected by the test above, and their estimates still imply that QOL and city size are negatively related.

6 Quality of Life and Individual Amenities

6.1 Two-Step Estimates

The QOL estimates may be used to determine how much value households put on particular amenities simply by estimating the city-level regression

$$\hat{Q}^j = \sum_k \pi_k^Q Z_k^j + \varepsilon^{Qj} \tag{10}$$

where $\pi_k = -(p_Q/m)\left(\partial\tilde{Q}/\partial Z_k\right)\pi_k$ measures the percentage of income an individual is willing to sacrifice to live in a city with one more unit of this amenity. This coefficient should be multiplied by household income ($49,500 in 2000) to obtain the dollar value an average household is willing to pay for amenity k. The error term ε^j contains measurement error, unobserved amenities, differences in housing quality (which raise the error term), and differences in worker ability (which lower it). The separate contribution of wage and housing-cost effects are presented using estimates of the form

$$\hat{w}^j = \sum_k Z_k^j \pi_k^w + \varepsilon^{wj} \ , \ \hat{p}^j = \sum_k Z_k^j \pi_k^p + \varepsilon^{pj}$$

where the model implies that

$$\pi_k^Q = (1-\delta\tau')s_y \pi_k^p - (1-\tau')s_w \pi_k^w . \tag{11}$$

Beginning with Rosen (1979), previous studies have typically estimated amenity values by directly estimating individual-level wage and housing-cost equations of the form (7) and (8), except with a vector of amenity variables in place of MSA dummy variables. This one-step method produces estimates of π_k^p and π_k^w similar to the two-step method outlined above when the same amenities and weights are used in both equations (Amemiya 1978). The previous studies have all inferred amenity values using the formula $\hat{\pi}_k^{Q*} = s_y \hat{\pi}_k^p - \hat{\pi}_k^w$ and have typically estimated the QOL differential using the formula $\hat{Q}^{j*} = \sum_k \hat{\pi}_k^{Q*} Z_k^j$, a measure which ignores unmeasured amenities in ε^{Qj}. Standard errors from the one-step method tend to be too small, as amenities only vary across cities, and not across individuals within a city, so that the effective sample size is the number of cities, not the number of individuals in the sample (Gyourko, Kahn, and Tracy 1999). The two-step method, on the other hand, provides conservative standard errors (Wooldridge 2003).[23] Furthermore, the two-step method proposed here provides a coefficient of multiple correlation, or R-squared, from (10), which gives the fraction of QOL variation explained by the amenity vector.

Regardless of the improvements introduced here, inferring amenity values from inter-city differences in wages and housing costs faces a number of potential pitfalls. Across cities, there is a high degree of collinearity between the different amenity variables, making it difficult to obtain precise estimates, and limiting the number of amenity valuations that can be calculated. Unobserved amenities, such as a city's downtown charm or scenic beauty, may contribute to problems of omitted variable bias. Furthermore, artificial amenities may be highly endogenous, and estimates of their values should be subject to additional skepticism. Nevertheless, it is difficult to ascertain the value of certain natural amenities, such as climate, by any other methods.

6.2 Dependence of Quality of Life on Amenities

Means and standard deviations of the amenity variables are shown under each variable. Results for regressions of housing costs, wages, and both the adjusted and unadjusted QOL estimates on

[23] Clustering at the city level in the one-step method produces standard errors for amenity values similar to those in the two-step method.

amenities are reported in Table 4. Columns 1 through 4 give include only natural amenity variables as regressors. In column 3 the estimates based on adjusted QOL indicate that households pay to live in areas with sunshine, close to a coast, or free of extreme temperatures. The R-squared of 61 percent indicates that these four variables alone explain a majority of the variation in QOL, and thus when choosing which metropolitan area to live in, the amenities most Americans seem to care about are climate and coastal proximity.[24] The results based on unadjusted QOL estimates, in column 4, have much less explanatory power and are often counter-intuitive. They imply that individuals do not care for sunshine or mild summers and wish to be away from coasts. As seen in columns 1 and 2, areas with these amenities tend to have higher wages, as well as higher housing costs, and the unadjusted estimates put far too much weight on the higher wages than the higher housing costs, causing the problems in these estimates.

Columns 5 through 8 add artificial amenities that depend on a city's population. The results based on the adjusted QOL estimates in column 7 reveal a high willingness-to-pay to avoid urban disamenities such as air pollution, urban sprawl and violent crime, although the latter's value is not measured precisely. Yet households also wish to be near urban consumption amenities such as restaurants and bars, as well as arts and culture. Interestingly, high levels of residential land-use regulation have only a mild and statistically weak effect on QOL, at least at the metropolitan level. Federal spending in one's city is valued by households, although only by roughly half its dollar cost. Local expenditures net of taxes have a positive but insignificant effect on QOL, although interpreting this coefficient too literally when local governments face budget-balance restrictions poses difficulties.[25] Artificial amenities raise the R-squared term to 0.75 from 0.61, suggesting that they are important, but perhaps not as important as natural amenities in determining QOL. Most of the estimates based on unadjusted QOL in column 4 are insignificant, while the significant estimates pose problems: households seem to be averse to art and culture, as it appears in high-

[24]Excluding precipitation does not affect the R-squared figure. Other variables related to climate and geography, including latitude, wind speed, and humidity are not significant in these regressions. Separating Great Lake coasts from salt-water coasts results in slightly higher, but insignificantly different, valuations for sea coasts, although even these differences disappear once artificial amenities are included.

[25]An unrestricted regression where expenditures and taxes are entered seprately gives a positive coefficient on expenditures and a negative coefficient on taxes, although both coefficients are small and insignificant.

wage cities, while urban sprawl appears to be desirable, as it appears in low-wage cities. Note that compensation for some disamenities, such as low air quality, workers are compensated significantly through higher wages, rather than just lower housing costs. This is a sensible result when polluting industries are profitable and can afford to pay higher wages to help compensate their workers.

The estimated value of the weather amenities is considerably stable across both specifications. From the estimates on heating and cooling degree days, it appears that households are willing to pay even more to avoid hot summers than to avoid cold winters. If climate change increases the number of cooling degrees by the same number that it reduces the number of heating degree days, the estimates imply that households will be worse off. The estimated value for sunshine says that households are willing to sacrifice 3.4 percent of their income for one additional sunny day a week. The estimated value for living near the coast is almost halved from 3.1 percent in column 1 to 1.7 percent in column 3 since valuable artificial amenities are disproportionately located along the coast: while it is difficult to be sure of this value, the estimate appears plausible.[26]

6.3 Amenities and City Size

It is well established that certain amenities and disamenities vary strongly with population size: crime rates, pollution, and congestion typically increase with population, as do cultural opportunities and the variety of consumption goods (Rosen 1979; Glaeser, Kolko and Saiz 2001). Adding population as a control variable in (10) serves to control for many of the amenities, observed or not, that are correlated with city size.

The results of this approach are presented in Table 5. Columns 1 and 2 report the slopes of the regression lines in Figure 3 that show how population is positively related to the adjusted QOL estimates, but is very negatively related with the unadjusted QOL estimates. Adding natural amenities in column 3, the relationship between population and adjusted QOL disappears. These natural amenities explain the small but positive relationship observed between QOL and city size.

[26] Commuting time is not entered as an independent variable as this is an endogenous variable from the individual's viewpoint. Workers should be willing to commute longer hours in order to live in a more desirable metropolitan area. The possibility of using commuting time to infer QOL deserves serious consideration in further research.

Column 5, which presents how the log of population depends on these amenities, reveals that the key natural amenity is coastal location, as coastal cities are on average 3 times as large as non-coastal cities. Results in columns 6, 7, and 8 do not change these conclusions. The amenity valuations from the adjusted parametrization are largely unaffected by including population, although certain valuations are less precisely estimated, such as those for cultural amenities and land-use regulation, as these are highly correlated with population size.

While this analysis finds that there is no empirical relationship between city size and QOL it does not definitively prove that there is no causal relationship. The slightly positive relationship between QOL and population is reduced to zero once natural amenities are controlled for, as the population size endogenously depends on available amenities. It is conceivable that, holding natural amenities fixed, adding population to existing cities could lower QOL by increasing artificial urban disamenities. For this hypothesis to hold, there should be some unobserved, presumably natural, amenity that when controlled for would make the QOL-population gradient negative. Nevertheless, if this hypothesis is true, then controlling for artificial amenities should have caused the population-QOL gradient to rise, which it did not, as controlling for urban disamenities should have made larger cities more attractive. Furthermore, since the measured amenities explain much of the existing variation in QOL, it is difficult to imagine that there is some important unmeasured amenity that is obscuring a strong negative effect of population on QOL.

7 Conclusion

The population size of a metropolitan area does not appear to have an impact on its QOL: it appears that the amenities of urban life, such as those from cultural and consumption opportunities, largely compensate for the disamenities, such as pollution and crime. Presently in the United States there is no need to subtract QOL losses due to urbanization from national-income growth in measuring welfare changes over time, although the same may not have been true in the past or be currently true in developing countries. The lack of a relationship between QOL and city size suggests that negative externalities from greater urban density are likely few, or that such externalities are typically mitigated through urban management, which undermines the idea that cities are too large and that federal policies should create greater population balance by inducing households to leave larger cities through policies such as equalization payments. Such policies may be welfare-reducing as they would discourage individuals from living in areas where they most prefer. This may be said of federal taxes (Albouy 2009a), which discourage individuals from living in larger cities, where nominal wages are high, but real after-tax incomes are no higher than in the rest of the county.

Methodologically, it is encouraging that hedonic estimates, based on economic theory, are not at odds with popular notions of what cities are nice places to live. Estimates of the value of individual amenities suggest that popular ratings such as *Places Rated* should consider placing additional weight on factors such as weather and geographic location when producing their rankings. These estimates also raise additional concern over climate change as they find that households have a higher willingness-to-pay to avoid heat than to avoid cold.

The fact that a majority of QOL differences are explained by natural amenities has interesting policy implications, since these amenities cannot be affected by local governments. Perhaps greater attention should be placed on land-use policies which allow households to move to areas where they can enjoy the amenities they value most. Restrictions on housing development, such as in the clement, coastal areas of California, deprive households nationwide from living in areas that would make them better off. While these restrictions may bolster local housing prices by making local amenities more scarce, ultimately they may lower the value of local land. Furthermore, although restrictions that limit urban growth may limit urban disamenities such as congestion, they are unlikely to improve the QOL of their residents as they prevent the creation of urban amenities, such as consumption and cultural opportunities.

This work may renew confidence that hedonic methods, when properly applied, may produce sensible results even relying on cross-sectional variation with data on wages and housing costs alone, although all of the estimates provided here certainly deserve greater scrutiny using more sophisticated methods and data. By being more careful in its accounting, this work should also help to improve further research on quality of life and local labor markets using richer models, which could account for preference heterogeneity or the imperfect mobility of households, possibly incorporating dynamics and measures based on quantities as well as prices.

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TABLE 1: WAGE, HOUSING-COST, AND QUALITY-OF-LIFE DIFFERENTIALS, 2000

	Population Size	Adjusted Differentials: Wages	Adjusted Differentials: Housing Cost	Quality-of Life	QOL Rank	Unadj. QOL Rank
Main city in MSA/CMSA						
Honolulu, HI	876,156	-0.01	0.49	0.165	1	19
Santa Barbara, CA	399,347	0.11	0.67	0.158	2	90
Salinas, CA	401,762	0.09	0.53	0.126	3	108
Santa Fe, NM	147,635	-0.06	0.25	0.115	4	20
San Luis Obispo, CA	246,681	0.02	0.40	0.115	5	59
San Francisco, CA	7,039,362	0.26	0.75	0.114	6	231
San Diego, CA	2,813,833	0.06	0.44	0.108	7	105
Los Angeles, CA	16,373,645	0.13	0.40	0.065	17	202
Seattle, WA	3,554,760	0.08	0.28	0.049	30	185
Miami, FL	3,876,380	-0.01	0.13	0.046	33	123
Boston, MA	5,819,100	0.14	0.35	0.045	34	219
Denver, CO	2,581,506	0.05	0.20	0.045	35	163
Portland, OR	2,265,223	0.03	0.17	0.041	37	158
New York, NY	21,199,865	0.21	0.42	0.033	43	238
Phoenix, AZ	3,251,876	0.03	0.10	0.018	62	180
Tampa, FL	2,395,997	-0.06	-0.05	0.013	67	115
Sioux Falls, SD	172,412	-0.12	-0.18	0.007	76	62
Chicago, IL	9,157,540	0.14	0.22	0.004	80	234
Washington, DC	7,608,070	0.13	0.17	-0.012	116	235
Cleveland, OH	2,945,831	0.01	-0.04	-0.017	126	198
Minneapolis, MN	2,968,806	0.09	0.06	-0.023	143	232
St. Louis, MO	2,603,607	0.01	-0.09	-0.031	170	205
Atlanta, GA	4,112,198	0.08	0.02	-0.032	175	233
Dallas, TX	5,221,801	0.07	0.01	-0.033	176	229
Philadelphia, PA	6,188,463	0.12	0.07	-0.036	184	237
Detroit, MI	5,456,428	0.13	0.09	-0.037	186	239
Pittsburgh, PA	2,358,695	-0.04	-0.17	-0.038	188	178
Houston, TX	4,669,571	0.07	-0.08	-0.060	221	236
Census Division						
Pacific	45,042,272	0.10	0.36	0.07	1	6
Mountain	18,174,904	-0.05	0.02	0.03	2	1
New England	13,928,540	0.07	0.18	0.02	3	7
South Atlantic	51,778,682	-0.03	-0.06	0.00	4	5
Middle Atlantic	39,668,438	0.08	0.11	-0.01	5	9
West North Central	19,224,096	-0.11	-0.25	-0.03	6	2
West South Central	31,440,101	-0.07	-0.21	-0.03	7	4
East North Central	45,145,135	0.00	-0.09	-0.03	8	8
East South Central	17,019,738	-0.12	-0.30	-0.04	9	3
MSA Population						
MSA, Pop > 5 Million	81,606,427	0.16	0.32	0.03	1	5
MSA, Pop 1.5-4.9 Million	55,543,090	0.03	0.05	0.00	2	4
MSA, Pop 0.5-1.4 Million	40,499,870	-0.03	-0.07	-0.01	4	3
MSA, Pop < 0.5 Million	36,417,747	-0.09	-0.15	-0.01	3	2
Non-MSA areas	67,354,772	-0.14	-0.28	-0.02	5	1
United States	281,421,906	0.13	0.29	0.05		
	total	*standard deviations*				

Wage and housing price data are taken from the U.S. Census 2000 IPUMS. Wage differentials are based on the average logarithm of hourly wages for full-time workers ages 25 to 55. Housing price differentials based on the average logarithm of rents and housing prices for units first occupied within the last 10 years. Adjusted differentials are city-fixed effects from individual level regressions on extended sets of worker and housing covariates.

TABLE 2: REGRESSION OF HOUSING COSTS ON WAGE LEVELS, AND A TEST OF THE CALIBRATED SLOPE COEFFECIENT FOR THE MOBILITY CONDITION

		Cities Only		
	No Controls (1)	No Controls (2)	Controls for Natural Amenities (3)	Controls for Natural and Artificial Amenities (4)
Panel A: Slope Estimates				
Wage differential	2.02	2.03	1.55	1.25
(robust s.e.)	(0.06)	(0.17)	(0.11)	(0.14)
R-squared	0.82	0.74	0.89	0.93
Number of Observations	290	241	230	193
Panel B: p-value of test that the regression slope equals the mobility-condition slope				
Adjusted slope = 1.54	0.00	0.01	0.90	0.04
Unadjusted slope = 4.00	0.00	0.00	0.00	0.00
Panel C: Implied relationship between wages and (residual) quality of life, b_Q				
Adjusted	0.48	0.49	0.01	-0.29
Unadjusted	-1.98	-1.97	-2.45	-2.75

Natural amenities, listed in Tables 4 and 5 include heating degree days, cooling degree days, percent of sunshine possible, inches of precipitation, and proximity to a coast. Artificial amenities include violent crime rate per capita, median air quality index, bars and restaurants per capita, *Places Rated* arts and culture index, residential land-use regulation and sprawl indices, local government expenditures net of local taxes, and federal spending differentials.

TABLE 3: RANK CORRELATION OF QUALITY-OF-LIFE WITH POPULAR, STATED-PREFERENCE, AND PREVIOUS HEDONIC METHODS

	Adj. QOL (1)	Unadj. QOL (2)
Panel A: Places Rated Almanac "Livability" Index		
Raw Score	0.24	-0.25
Revised Score	0.30	-0.32
Number of Metro Areas	240	240
Panel B: PEW Stated-Preference Ranking		
"Yes" answers	0.70	0.54
Absence of "No" answers	0.66	0.55
Number of Metro Areas	28	28
Panel C: Gabriel et al. (2003) State Rankings		
Ranking from 1990	0.06	0.74
Ranking from 1980	0.10	0.75
Number of States	50	50
Panel d: Chen and Rosenthal (2008) 2000 Rankings		
Metro Areas Only	0.80	0.81
Including Non-Metro Areas	0.78	0.80
Number of Metro Areas	241	241
Number of Non-Metro Areas	49	49

Places rated ranking used for first city in CMSA. Revised Places Rated Score eliminates cost-of-living and job-market components. Chen and Rosenthal estimates aggregated from the PMSA to CMSA level using averages weighted by population. All ranking correlations are highly significant, with p-values less than 0.01.

TABLE 4: QUALITY-OF-LIFE ESTIMATES AND INDIVIDUAL AMENITIES

Type of Amentiy Variables	Natural Amenities Only				Natural and Artificial Amenities			
Dependent Variables	Hous. Cost	Wages	Adj QOL	Unadj. QOL	Hous. Cost	Wages	Adj QOL	Unadj. QOL
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Heating-Degree Days, 1000s	-0.033	0.002	-0.011***	-0.010*	-0.010	-0.062***	-0.015***	-0.006
(mean = 4.22, sd = 2.04)	(0.024)	(0.011)	(0.004)	(0.006)	(0.009)	(0.013)	(0.003)	(0.006)
Cooling-Degree Days, 1000s	-0.192***	-0.051**	-0.036***	0.004	-0.048***	-0.169***	-0.031***	0.005
(mean = 1.34, sd = 0.95)	(0.047)	(0.021)	(0.008)	(0.012)	(0.016)	(0.025)	(0.005)	(0.012)
Sunshine, fraction possible	1.546***	0.433*	0.287***	-0.046	0.149	0.969***	0.239***	0.093
(mean = 0.61, sd = 0.09)	(0.454)	(0.227)	(0.068)	(0.135)	(0.138)	(0.204)	(0.052)	(0.108)
Precipitation, 10s of inches	0.020	0.007	0.003	-0.002	0.019**	0.034**	0.002	-0.011*
(mean = 3.92, sd = 1.32)	(0.026)	(0.013)	(0.004)	(0.007)	(0.009)	(0.015)	(0.003)	(0.006)
Proximity to Coast, salt or fresh water	0.271***	0.112***	0.031***	-0.044***	0.025	0.097***	0.017**	0.000
(mean = 0.59, sd = 0.49)	(0.041)	(0.021)	(0.007)	(0.014)	(0.017)	(0.031)	(0.007)	(0.013)
Violent Crimes per Capita					-6.408	-16.104*	-1.739	2.382
(mean = 0.005, sd = 0.003)					(4.330)	(9.068)	(2.061)	(3.144)
Median Air Quality Index/100					0.090	-0.086	-0.074***	-0.112**
(mean = 0.50, sd = 0.13)					(0.082)	(0.135)	(0.024)	(0.056)
Restaurants and Bars per Thousand					0.003	0.101**	0.031**	0.023
(mean = 1.43, sd = 0.28)					(0.039)	(0.045)	(0.013)	(0.032)
Places Rated Arts & Culture Index/100					0.182***	0.352***	0.025**	-0.094***
(mean = 0.82, sd = 0.24)					(0.031)	(0.052)	(0.012)	(0.023)
Residential Land Use Regulatory Index					0.031***	0.077***	0.009	-0.012
(mean = 0.25, sd = 0.68)					(0.010)	(0.022)	(0.006)	(0.008)
Sprawl Index/10					-0.031***	-0.068***	-0.007**	0.014**
(mean = 4.00, sd = 0.99)					(0.010)	(0.018)	(0.003)	(0.007)
Local Expenditures net of Local Taxes					0.111**	0.197**	0.007	-0.062
(mean = 0.00, sd = 0.16)					(0.056)	(0.093)	(0.019)	(0.041)
Federal Spending Differential					0.122	1.328	0.361*	0.210
(mean = 0.00, sd = 0.01)					(0.594)	(0.820)	(0.213)	(0.467)
Constant	-0.682	-0.246	-0.100	0.076	-0.071	-0.263	-0.051	0.005
	(0.441)	(0.216)	(0.063)	(0.124)	(0.160)	(0.230)	(0.054)	(0.122)
R-squared	0.65	0.44	0.61	0.24	0.75	0.86	0.75	0.54
Number of Observations	230	230	230	230	193	193	193	193

Robust standard errors shown in parentheses. * p<0.1, ** p<0.05, *** p<0.01. Regressions weighted by the sum of individuals in a city, each according to their predicted income in an average city.

TABLE 5: QUALITY-OF-LIFE ESTIMATES, INDIVIDUAL AMENITIES, AND CITY SIZE

Type of Amentiy Variables	Population Only		Natual Amenities Only			Natural and Artificial Amenities		
Dependent Variables	Adj. QOL	Unadj. QOL	Adj. QOL	Unadj. QOL	Log(Pop)	Adj. QOL	Unadj. QOL	Log(Pop)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Logarithm of Population	0.011***	-0.033***	0.001	-0.037***		0.000	-0.041***	
	(0.003)	(0.004)	(0.002)	(0.002)		(0.004)	(0.007)	
Heating-Degree Days, 1000s			-0.012***	-0.009**	0.025	-0.015***	-0.010*	-0.111**
			(0.004)	(0.004)	(0.131)	(0.003)	(0.005)	(0.053)
Cooling-Degree Days, 1000s			-0.036***	-0.004	-0.198	-0.031***	-0.006	-0.284***
			(0.008)	(0.009)	(0.194)	(0.005)	(0.011)	(0.102)
Sunshine, fraction possible			0.284***	0.066	3.083	0.239***	0.068	-0.614
			(0.066)	(0.075)	(3.304)	(0.052)	(0.087)	(1.450)
Precipitation, 10s of inches			0.003	-0.003	-0.022	0.002	-0.003	0.197
			(0.004)	(0.004)	(0.195)	(0.003)	(0.005)	(0.132)
Proximity to Coast, salt or fresh water			0.030***	0.017**	1.683***	0.017**	0.020*	0.494***
			(0.007)	(0.008)	(0.321)	(0.007)	(0.011)	(0.152)
Violent Crimes per Capita						-0.074***	0.031	3.495***
						(2.074)	(2.642)	(44.495)
Median Air Quality Index/100						-0.074***	0.031	3.495***
						(0.027)	(0.051)	(0.649)
Restaurants and Bars per Thousand						0.031**	0.013	-0.243
						(0.013)	(0.023)	(0.360)
Places Rated Arts & Culture Index/100						0.025*	0.011	2.563***
						(0.015)	(0.025)	(0.294)
Residential Land Use Regulatory Index						0.009	0.004	0.400***
						(0.006)	(0.008)	(0.103)
Sprawl Index/10						-0.007*	-0.004	-0.446***
						(0.004)	(0.006)	(0.130)
Local Expenditures net of Local Taxes						0.007	-0.043	0.471
						(0.020)	(0.031)	(0.528)
Federal Spending Differential						0.361*	0.114	-2.351
						(0.212)	(0.353)	(4.433)
Constant	-0.153***	0.457***	-0.112	0.520***	12.161***	-0.050	0.553***	13.399***
	(0.046)	(0.056)	(0.073)	(0.068)	(3.084)	(0.080)	(0.137)	(1.565)
R-squared	0.11	0.54	0.61	0.67	0.37	0.75	0.67	0.85
Number of Observations	241	241	230	230	230	193	193	193

Robust standard errors shown in parentheses. * p<0.1, ** p<0.05, *** p<0.01. Regressions weighted by the sum of individuals in a city, each according to their predicted income in an average city.

Figure 1: Housing Costs versus Wage Levels across Metro Areas, 2000

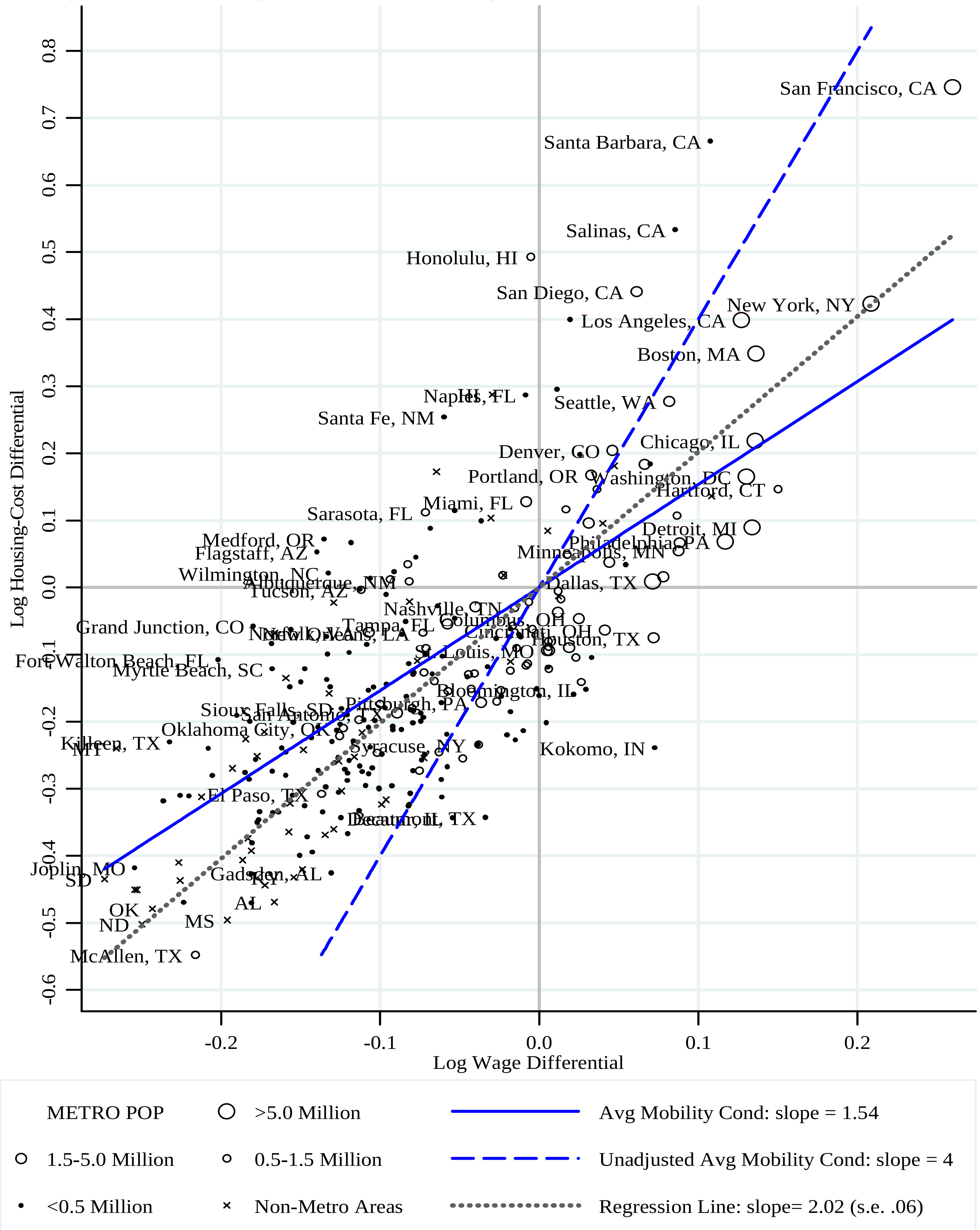


Figure 2: Quality-of-life Estimates: Adjusted vs. Unadjusted

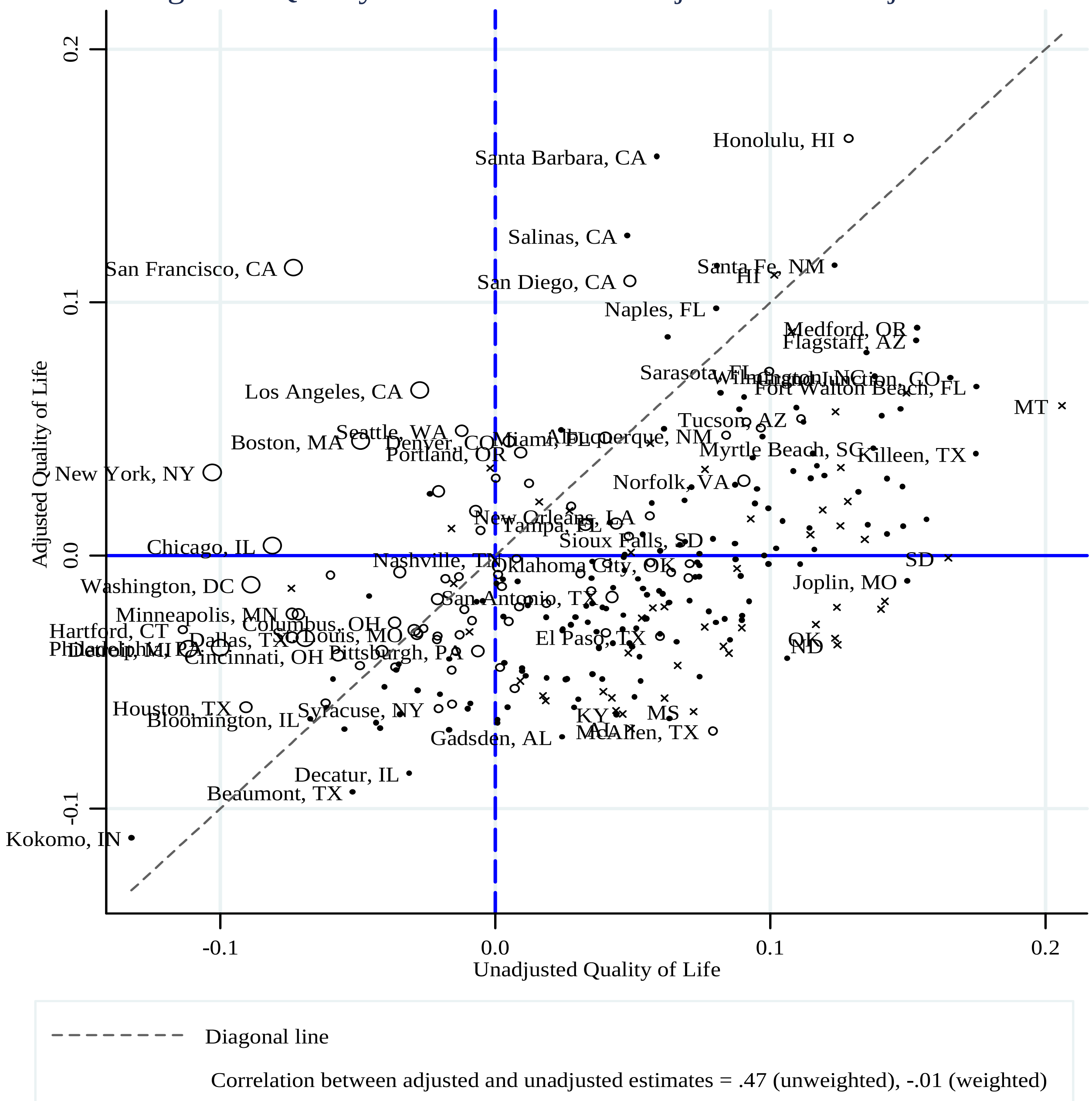


Figure 3: Quality of Life and City Size

Figure 3a: Adjusted Quality of Life

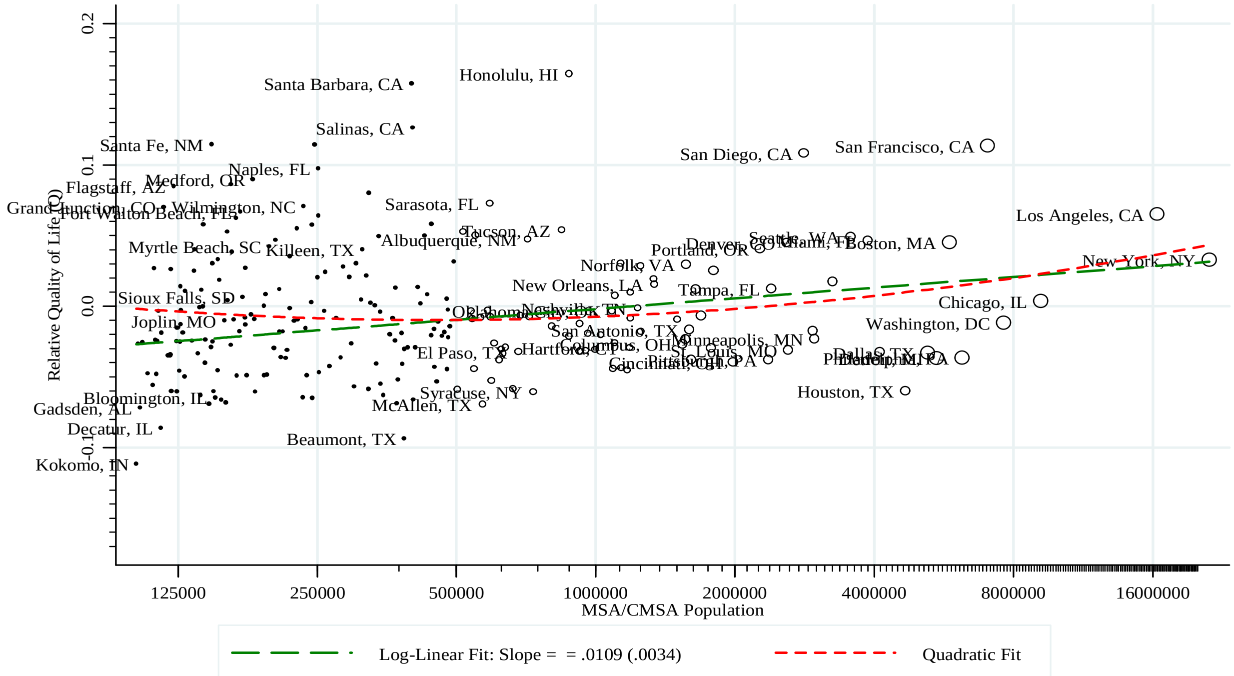
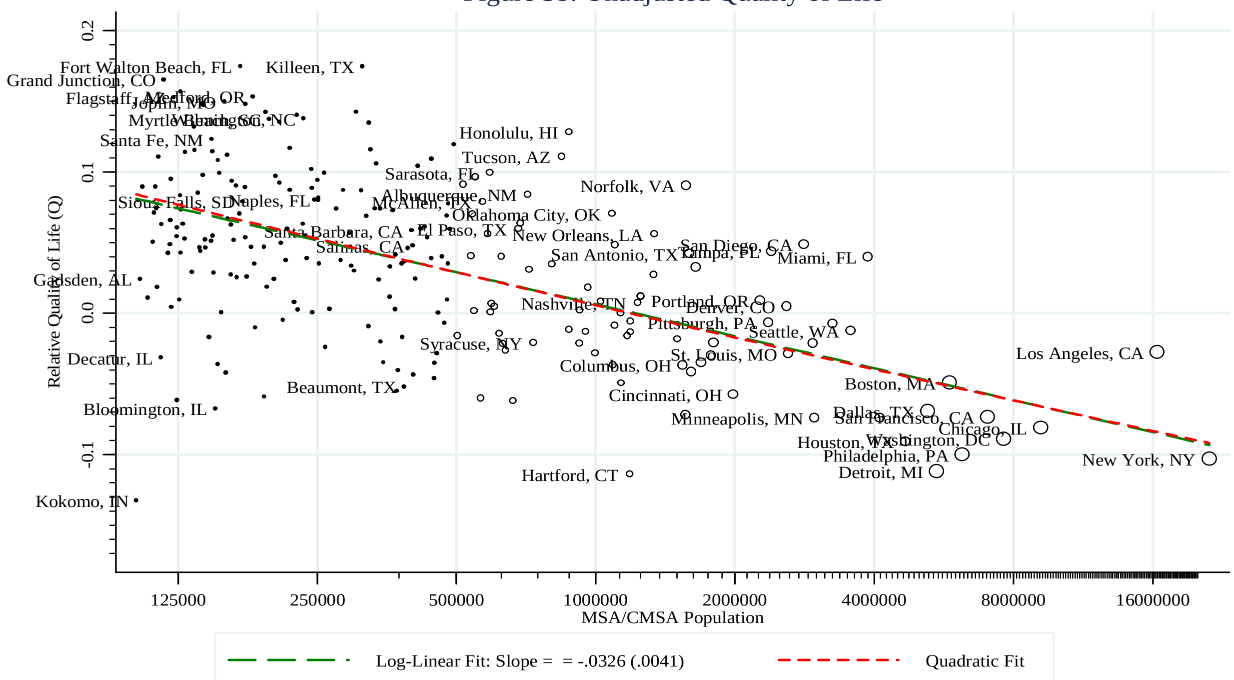


Figure 3b: Unadjusted Quality of Life



Appendix - Not for Publication

A Additional Theoretical Details

A.1 Aggregation of Types

Assume there are two types of fully mobile households, referred to as "a" and "b," and that some members of each type lives in every city. Ignoring the deduction, the mobility conditions for each type of household are

$$e^a(p^a, w^a, \tau^a, u; Q^a) = 0 \quad \text{(A.1a)}$$
$$e^b(p^b, w^b, \tau^b, u; Q^b) = 0 \quad \text{(A.1b)}$$

A third equation is used to model production of the tradable good x, which has a unit price. Production is assumed to have constant returns to scale in labor, which can differ by household, together with capital and home-goods, which can be used as inputs. In equilibrium, because firms are mobile, the unit cost function for x must equal the price of x, which is one

$$c_X(w^a/A_X^a, w^b/A_X^b, p) = 1 \quad \text{(A.2)}$$

The terms A_X^a and A_X^b give the relative productivity of each worker type in the city. Log-linearizing equations (A.1a), (A.1b), and (A.2),

$$s_y^a \hat{p} - (1 - \tau^{a\prime}) s_w^a \hat{w}^a = \hat{Q}^a \quad \text{(A.3a)}$$
$$s_y^b \hat{p} - (1 - \tau^{b\prime}) s_w^b \hat{w}^b = \hat{Q}^b \quad \text{(A.3b)}$$
$$\theta_N^a \hat{w}^a + \theta_N^b \hat{w}^b + \theta_Y \hat{p} = \theta^a \hat{A}_X^a + \theta^b \hat{A}_X^b \equiv \hat{A}_X \quad \text{(A.3c)}$$

where θ is used to denote the cost-shares of each factor. This is similar to the models seen in Roback (1988) and Beeson (1991), although these authors assume that $s_w^a = s_w^b = 1$, and do not include taxes. Let the share of total income accruing to type a worker be $\mu^a = N^a m^a / \left(N^a m^a + N^b m^b\right)$, with the other share $\mu^b = 1 - \mu^a$, and define the following income-weighted averages

$$s_y = \mu^a s_y^a + \mu^b s_y^b \quad \text{(A.4a)}$$
$$\hat{Q} = \mu^a \hat{Q}^a + \mu^b \hat{Q}^b \quad \text{(A.4b)}$$

and let $s_x = 1 - s_y$.

A case worth considering is one where type-a households receive all of their income from wages, and type-b households receive all their income from capital and land. This approximates the situations of prime-age workers, whose incomes are fully tied to local-wage levels, and retirees, whose incomes are completely independent of local-wage levels. Thus $\mu^a = s_w = s_x \theta_N^a$ and $\mu^b = 1 - s_w = s_y + s_x(1 - \theta_N^a)$. In this situation, we expect a-types to sort into high-wage cities, and b-types into low-wage cities. Nevertheless, approximating around the average city where sorting effects are neutralized, (A.3a) and (A.3b) become

$$s_y^a \hat{p} - (1 - \tau^{a\prime})\hat{w}^a = \hat{Q}^a$$
$$s_y^b \hat{p} = \hat{Q}^b$$

Averaging these two equations according to their shares of total income, s_w and $1 - s_w$, produces equation (3) in the main text. This result is more approximate in cities with prices and wages far from the average, where sorting is more of an issue. In high-wage cities labor income should be weighed more heavily, while in low-wage cities, non-labor income should be weighed more heavily.

An advantage of using income-weighted averages is that it produces sensible comparative statics results when considering the effect of differences in QOL and productivity for either household-type on wages and home-good prices. Ignoring taxes for expositional ease, solving the system reveals the wage differential for a type a household:

$$s_w^a \hat{w}^a = \frac{\mu^b}{s_R}\left(s_y^a \hat{Q}^b - s_y^b \hat{Q}^a\right) - \frac{s_x \theta_Y}{s_R}\hat{Q}^a + \frac{s_x}{s_R} s_y \hat{A}_X \tag{A.5}$$

where $s_R = s_y + s_x \theta_Y$. An analogous expression holds for $\hat{w}^b$. The term beginning with μ^b explains how a-type are paid less in cities with amenities they value, $\hat{Q}^a > 0$, but are paid more in cities with amenities that b-types value, $\hat{Q}^b > 0$. Both types are paid more in productive cities, $\hat{A}_X$, regardless of which type of labor is made more productive. The home-good and average wage differential, weighted by wage-income shares, aggregate neatly into:

$$\hat{p} = \frac{1}{s_R}\hat{Q} + \frac{s_x}{s_R}\hat{A}_X \tag{A.6}$$

$$\hat{w} \equiv \frac{1}{s_w}\left(s_w^a \mu^a \hat{w}^a + s_w^b \mu^b \hat{w}^b\right) = -\frac{\theta_Y}{\theta_N s_R}\hat{Q} + \frac{s_y s_x}{s_R}\hat{A}_X \tag{A.7}$$

A.2 Functional Form and Aggregation over Incomes

Assume that utility takes the following form with separable labor supply and σ_Q representing the elasticity of substitution between Q and the composite commodity $\phi(x, y)$, where ϕ is homothetic:

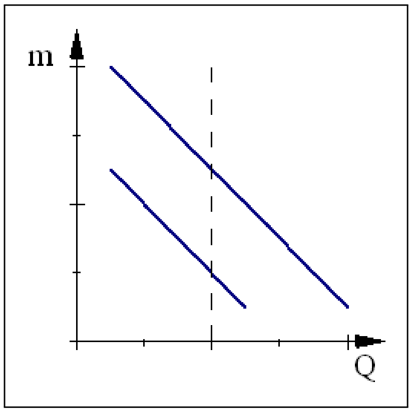
$$U(x, y; Q) = \left[\omega Q^{\frac{\sigma_Q - 1}{\sigma_Q}} + \phi(x, y)^{\frac{\sigma_Q - 1}{\sigma_Q}}\right]^{\frac{\sigma_Q}{\sigma_Q - 1}}$$

Then it is possible to show that

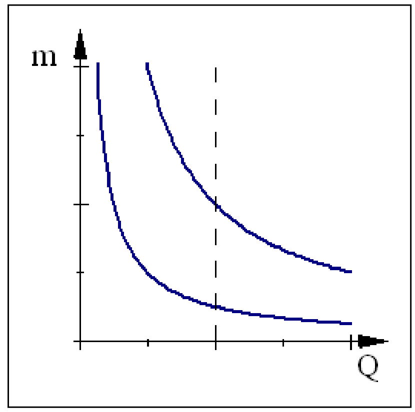
$$p_Q = \frac{\partial V/\partial Q}{\partial V/\partial m} = \frac{\omega}{\lambda}\left(\frac{m\lambda}{Q}\right)^{\frac{1}{\sigma_Q}}$$

where $\lambda =$ the marginal utility of consumption. In the case where quality-of-life and consumption are perfect substitutes, $\sigma_Q \to \infty$, then $p_Q = \omega/\lambda$, which is constant If instead, preferences are

Cobb-Douglas, $\sigma_Q = 1$, then, $p_Q = \omega m/Q$, and $\hat{Q} = \omega \cdot dQ$. Indifference curves for the two cases are illustrated below



Perfect Substitutes



Cobb-Douglas

In the perfect substitutes case, the willingness to pay for quality-of-life remains constant with income. In the Cobb-Douglas case, the willingness to pay rises proportionally with income. It is this latter case which more consistent with the theoretical presentation and with the the semi-logarithmic functional forms justified empirically in Section C.3.

A.3 Second-Order Approximation of the Mobility Condition

The first-order approximation of QOL in equation (3) may be expanded into a second order approximation, which solves the quadratic equation

$$\frac{1}{s_x + s_y}(\hat{Q}^j)^2 - \left(\frac{s_y}{s_x + s_y}\hat{p} + 1\right)\hat{Q}^j + s_y\left(1 - \frac{1}{2}\eta^c\hat{p}^j\right)\hat{p}^j - (1-\tau')s_w\left[1 + \frac{1}{2}\varepsilon_{(1-\tau')}s_w\hat{w}^j\right]\hat{w}^j = 0 \tag{A.8}$$

where η^c is the compensated elasticity of demand for home goods, and $\varepsilon_{(1-\tau')}$ is the elasticity of the marginal net of tax rate $(1-\tau')$ with respect to income, m, or

$$\varepsilon_{(1-\tau')} = \frac{d\ln(1-\tau')}{d\ln m} = \frac{-\tau''}{1-\tau'}m$$

In a progressive tax system the marginal tax rate is increasing, so $\tau'' > 0$, implying that this elasticity should be negative. Equation (A.8) accounts for three phenomena. First, if $\sigma_D < 1$, then the home-good expenditure share, s_y, increases with $\hat{p}^j$, as the demand for home goods is inelastic. Second, because of progressivity, households who move to higher-wage areas pay a higher tax rate, reducing the net-of tax rate $(1-\tau')$. Third, households in higher-wage areas derive a larger fraction of income from labor sources, seen in an increasing s_w.

The impact of using the second-order approximation is considered using parameter values of η^c and $\varepsilon_{(1-\tau')}$ that lead to the largest plausible deviation from the first-order approximation. A value of $\eta^c = 0.5$ is close to the lower bound of plausible values from a variety of housing-demand estimates, including Rosen (1985), Goodman and Kawai (1986), Goodman (1988) Ermisch et al. (1996), Goodman (2002), and Ionnides and Zabel (2003). Estimates of $\varepsilon_{(1-\tau')}$ that I obtained using data from Piketty and Saez (2007) are small, with a value of $\varepsilon_{(1-\tau')} = -0.1$ being the furthest plausible value away from zero.

Using these values, mobility conditions for $\hat{Q}^j$ levels of 0.1, 0, and -0.1 are plotted in Figure A1 using the first-order approximation, shown by the solid lines, and the second-order, shown by the dashed lines Overall, the first and second-order approximations are similar. A closer look of the second-order approximation suggests that the first-order QOL estimates may be overrestimated in high-wage-high-cost areas, but only by a very small amount.

B Taste Heterogeneity and Housing-Supply Restrictions

Recent work by Quigley and Raphael (2005), Glaeser et al. (2005), and Gyourko et al. (2006) argues that supply restrictions on housing in certain areas, such as California, have caused housing costs in these areas to increase disproportionately. Yet, in the traditional hedonic framework with homogenous households, supply restrictions in a single city raise housing costs everywhere uniformly; restrictions do not affect the relative price in that city, holding wages constant, although it should affect population size.

B.1 Modeling Heterogeneity and Imperfect Mobility

Although modeling heterogenous households can produce perplexing results, it is possible to incorporate a continuous form of heterogeneity into the standard hedonic model that is fairly tractable and elegant. Suppose that QOL in city j is dependent on a universal component Q_0^j and an a component that varies by household i, ξ_i^j, so that overall QOL for household i in city j is given by $Q_i^j = Q_0^j \xi_i^j$. Furthermore, assume that ξ_i^j is Pareto distributed with parameter $1/\psi$

$$F(\xi_i^j) = 1 - (\underline{\xi}^j/\xi_i^j)^{1/\psi},\ \xi_i^j \geq \underline{\xi}^j$$

A higher ψ implies greater heterogeneity in preferences, with $\psi = 0$ corresponding to the standard model with homogenous households. For simplicity, set $\delta = 0$ and assume that the outside utility for households is given by a constant $\bar{u}$. For some given constant, $N_{\max}^j$, and some marginal household k with taste parameter ξ_k^j, the population in city j is $N^j = N_{\max}^j \Pr(\xi_i^j \geq \xi_k^j) = N_{\max}^j[1 - F(\xi_k^j)] = N_{\max}^j(\underline{\xi}/\xi_k^j)^{1/\psi}$. Hence,

$$\log N^j = \ln N_{\max}^j + \frac{1}{\psi}[\log \underline{\xi} - \log \xi_k^j] \tag{A.9}$$

Fully differentiating the equilibrium condition (1), treating N as an endogenous variable, and noting that (A.9) implies $\hat{N}^j = -\hat{\xi}_k^j/\psi$, leads to an extended version of equation (3)

$$s_y \hat{p}^j - s_w(1-\tau')\hat{w}^j = \hat{Q}_0^j - \psi \hat{N}^j \tag{A.10}$$

This says that the QOL for the marginal household of city j decreases with population size, as more marginal households enter a city. In order to decrease the city population by a full one percent, city residents need to see their real income drop by ψ percent.

Holding $\hat{w}^j$ and $\hat{Q}_0^j$ constant, (A.10) provides a downward-sloping demand curve for residence in city j given in terms of home-good prices

$$\hat{N}^j = -(s_y/\psi)\hat{p}^j \tag{A.11}$$

Holding $\hat{p}^j$ and $\hat{Q}_0^j$ constant, (A.10) provides an upward-sloping local-labor supply curve

$$\hat{N}^j = \left[s_w\left(1-\tau'\right)/\psi\right]\hat{w}^j \tag{A.12}$$

In general, ψ parametrizes household mobility: $\psi = 0$ implies perfect mobility, as in the standard model, while $\psi = \infty$ implies perfect immobility. The greater the amount of heterogeneity, the greater the willingness-to-pay to live in a city varies across individuals, and the less mobile are inframarginal households when housing costs rise or wages fall. Mobility may be thought to increase with time, so that ψ decreases with the time elapsed after the change-inducing event in question.

B.2 Effect of a Quality-of-Life Improvement

This model has several applications. Two simplified cases are examined here: the effect of an exogenous increase in an amenity, and the effect of a supply restriction on housing supply. For ease, assume that the total amount of traded good produced in city j is $X^j = A_X^j N^j h^j$, so that wages are determined exogenously by productivity in the traded sector, $w^j = A_X^j$. The total amount of the home good $Y^j = N^j y^j$ is produced directly from land $\bar{L}_j$, which is fixed in supply. Each city may differ in productivity in the home-good sector, A_Y^j, so that supply $Y^j = A_Y^j \bar{L}^j$. Because markets are competitive, all payments to home goods go to land, and so $r^j \bar{L}^j = p^j Y^j = p^j A_Y^j \bar{L}^j$, implying $r^j = p^j A_Y^j$.

Now assume that there is an exogenous increase in quality-of-life given by $d\hat{Q}_0^j > 0$, so that $s_y d\hat{p}^j = d\hat{Q}_0^j - \psi \hat{N}^j$. Since Y^j is fixed, $d\hat{N}^j = -d\hat{y}^j = -\eta^u \hat{p}^j = |\eta^u|\,\hat{p}^j$ where $\eta^u < 0$ is the uncompensated price elasticity of housing. As a result, both home-good prices and population size increase

$$d\hat{p}^j = \frac{1}{s_y + \psi\,|\eta^u|} d\hat{Q}_0^j$$
$$d\hat{N}^j = \frac{|\eta^u|}{s_y + \psi\,|\eta^u|} d\hat{Q}_0^j$$

In this case, the value of the amenity improvement is not fully captured by the price change. Migrants compelled to move into the city to take advantage of the improved amenity value the city less in other ways. Thus prices are lower relative to the case where all households are homogenous. Welfare of inframarginal residents of city j increases by

$$d\hat{Q}_0^j - s_y d\hat{p}^j = \psi d\hat{N}^j = \frac{\psi\,|\eta^u|}{s_y + \psi\,|\eta^u|} d\hat{Q}_0^j$$

In the case where $\psi \to \infty$, no inflow of population occurs, prices do not rise, and residents receive a welfare gain of $d\hat{Q}_0^j$.

B.3 Effect of Supply Restrictions

Suppose that housing supply restrictions reduce the amount of home goods that can be produced from land, causing $d\hat{A}_Y^j < 0$. It then follows that $d\hat{A}^j = d\hat{Y}^j = d\hat{y}^j + d\hat{N}^j = \eta^u d\hat{p}^j + d\hat{N}^j$. Combining this with $s_y d\hat{p}^j = -\psi dN^j$ produces the results

$$d\hat{p}^j = -\frac{\psi}{s_y + \psi\,|\eta^u|} d\hat{A}_Y^j$$
$$d\hat{N}^j = \frac{s_y}{s_y + \psi\,|\eta^u|} d\hat{A}_Y^j$$

Thus, without heterogeneity $\psi = 0$, prices will not increase with supply restrictions and the population will decrease proportionally with the home-good supply.[27] The value of land, r^j, will likely decrease as $d\hat{r}^j = d\hat{p}^j - dA_Y^j$, implying

$$d\hat{r}^j = \frac{s_y + \psi\,(|\eta^u| - 1)}{s_y + \psi\,|\eta^u|} d\hat{A}_Y^j$$

With heterogenous households, supply restrictions can make housing relatively more expensive by essentially limiting the supply of city-specific amenities. For example, high levels of regulation in California, effectively lower the supply of coastal sunsets, raising their relative price. Comparatively lax housing policies in other parts of the Sunbelt (Glaeser and Tobio 2007) have increased the supply of mild winters, which may lower their relative price.

C Data and Estimation Details

C.1 Wage and Housing Cost Data

I use United States Census data from the 2000 Integrated Public-Use Microdata Series (IPUMS), from Ruggles et al. (2004), to calculate wage and housing price differentials. The wage differentials are calculated for workers ages 25 to 55, who report working at least 30 hours a week, 26 weeks a year. The MSA assigned to a worker is determined by their place of residence, rather than their place of work. The wage differential of an MSA is found by regressing log hourly wages on individual covariates and indicators for a worker's MSA of residence, using the coefficients on these MSA indicators. The covariates consist of

- 12 indicators of educational attainment;
- a quartic in potential experience, and potential experience interacted with years of education;
- 9 indicators of industry at the one-digit level (1950 classification);
- 9 indicators of employment at the one-digit level (1950 classification);

[27] This corresponds closely to the result of Aura and Davidoff (forthcoming) who calibrate the elasticity of prices with respect to housing supply. Establishing this equivalence requires noting that $f(\xi_j)\xi_j/[1 - F(\xi_j)] = 1/\psi$ and that $\xi_j = \theta_j/s_y$ in the Aura-Davidoff model. The parameter ψ can be adapted to their calibrations by using $\psi = s_y \ln r/(\ln 2f)$, where r is "Median Valuation θ/price q" and f is "Market Size/National Population."

- 4 indicators of marital status (married, divorced, widowed, separated);
- an indicator for veteran status, and veteran status interacted with age;
- 5 indicators of minority status (Black, Hispanic, Asian, Native American, and other);
- an indicator of immigrant status, years since immigration, and immigrant status interacted with black, Hispanic, Asian, and other;
- 2 indicators for English proficiency (none or poor).

All covariates are interacted with gender.

I first run the regression using census-person weights. From the regressions a predicted wage is calculated using individual characteristics alone, controlling for MSA, to form a new weight equal to the predicted wage times the census-person weight. These new income-adjusted weights are needed since workers need to be weighted by their income share (see Appendix A.1). The new weights are then used in a second regression, which is used to calculate the city-wage differentials from the MSA indicator variables. In practice, this weighting procedure has only a small effect on the estimated wage differentials.

Housing-cost differentials are calculated using the logarithm of rents, whether they are reported gross rents or imputed rents derived from housing values. Only housing units moved into within the last 10 years are included in the sample to ensure that the price data are fairly accurate. The differential housing cost of an MSA is calculated in a manner similar to wages, except using a regression of the actual or imputed rent on a set of covariates at the unit level. The covariates for the adjusted differential are

- 9 indicators of building size;
- 9 indicators for the number of rooms, 5 indicators for the number of bedrooms, number of rooms interacted with number of bedrooms, and the number of household members per room;
- 2 indicators for lot size;
- 7 indicators for when the building was built;
- 2 indicators for complete plumbing and kitchen facilities;
- an indicator for commercial use;
- an indicator for condominium status (owned units only).

I first run a regression of housing values on housing characteristics and MSA indicator variables using only owner-occupied units, weighting by census-housing weights. A new value-adjusted weight is calculated by multiplying the census-housing weights by the predicted value from this first regression using housing characteristics alone, controlling for MSA. A second regression is run using these new weights for all units, rented and owner-occupied, on the housing characteristics fully interacted with tenure, along with the MSA indicators, which are not interacted. The house-price differentials are taken from the MSA indicator variables in this second regression. As with the wage differentials, this adjusted weighting method has only a small impact on the measured price differentials.

C.2 Comparing Housing Costs and Rents

In measuring housing costs, it is sensible to use both rental and owner-occupied units, since together these capture the housing costs of residents in a city. Nevertheless, across cities the ratio of housing prices to rents can vary substantially. Figure A2 graphs the housing-cost differentials used above, which are based on both actual rents and imputed rents of owner-occupied units, against actual rents. Across most cities, rent and housing-price differences are fairly similar, and so the two measures are fairly close. In cities with housing-cost differentials above 0.2, such as Boston, Los Angeles, New York, and San Francisco, these housing-cost differentials are significantly larger than rent differentials. Since housing prices should reflect the present value of the stream of future rents, this suggests that relative rents in these cities were expected to rise, although it is not clear whether rents were expected to rise because of improvements in QOL, improvements in the local job-market, or for other reasons.

Using only rent differentials would result in lower QOL estimates for these higher-cost cities. However, there are a number of problems with using only rent differentials. First, rent control in cities such as San Francisco and New York may artificially depress rents. Second, as seen in Figure A3, home-ownership rates decline significantly as price-to-rent ratios rise, which implies that the share of rental units in the sample is larger in high-price cities. Using both rental and owner-occupied units avoids the issue of having to deal with changes in the sample composition due to changes in the home-ownership rate. In order to avoid these problems, and to preserve comparability with QOL estimates in the existing measure, the traditional measure of housing costs is used in the analysis here.

C.3 Functional Form

Wage and housing-cost differentials are measured logarithmically, so that $\hat{Q}^j$ in (3) is measured as the fraction of income a household is willing to pay (or to accept if negative) to live in city j, rather than an in an average city. Most studies have measured QOL in dollar terms, as in (2). As explained in Appendix A.2, when aggregating across households with different incomes, the choice of logarithms applies best when households value amenities proportionally to their income, rather than in stable dollar amounts regardless of income.

Empirically, the semi-logarithmic functional form in (7) and (8) is supported by work in Blomquist et al. (1988), who use maximum likelihood estimation with a Box-Cox transformation of the form $(w^\gamma - 1)/\gamma$. They find that a value of $\gamma = 0.1$ best fits the data for wages, and $\gamma = 0.2$ for housing costs, both of which are fairly close to $\gamma = 0$, which corresponds to the logarithm. Similar estimates (not shown) using much larger samples from the 2000 Census, and with MSA dummy variables on the right-hand side (rather than measured amenities), result in estimates of γ close to 0.1 for both wages and housing costs. This is not dependent on the control variables, as a similar value of γ is estimated if predicted effects of the controls are first subtracted from wages and prices, with the residuals then regressed on the MSA dummies. Thus, city wage and housing-cost differentials across worker and housing types are best expressed in percentage terms rather than in dollar amounts.

C.4 Amenity Data

Heating and cooling degree days (Annual) Degree day data are used to estimate amounts of energy required to maintain comfortable indoor temperature levels. Daily values are computed from each days mean temperature (max + min/2). Daily heating degree days are equal to $\max\{0, 65 - meantemp\}$ and daily cooling degree days are $\max\{0, meantemp - 65\}$. Annual degree days are the sum of daily degree days over the year. The data here refer to averages from 1970 to 2000 (National Climactic Data Center 2008).

Sunshine Average percentage of possible. The total time that sunshine reaches the surface of the earth is expressed as the percentage of the maximum amount possible from sunrise to sunset with clear sky conditions. (National Climactic Data Center 2008).

Precipitation (Inches) The normal precipitation is the arithmetic mean for each month over the 30-year period, adjusted as necessary, and includes the liquid water equivalent of snowfall (National Climactic Data Center 2008).

Coastal proximity Equal to one if one or more counties in the MSA is adjacent to an ocean coast or great lake; zero otherwise. Coded by author.

Violent crimes (per capita) These consist of aggravated assaults, robbery, forcible rape, and murder (*City and County Data Book 2000*).

Air quality index (Median) An AQI value is calculated for each pollutant in an area (ground-level ozone, particle pollution, carbon monoxide, sulfur dioxide, and nitrogen dioxide). The highest AQI value for the individual pollutants is the AQI value for that day. An AQI over 300 is considered hazardous; under 50, good; values in between correspond to moderate, unhealthy, and very unhealthy (Environmental Protection Agency, 2008).

Bars and restaurants Number of establishments classified as eating and drinking places (NAICS 722) in *County Business Patterns 2000*.

Arts and Culture Index from *Places Rated Almanac* (Savageau 1999). Based on a ranking of cities, it ranges from 100 (New York, NY) to 0 (Houma, LA).

Sprawl index Percentage of land not developed in the square kilometer around an average residential development in each metropolitan area in 1992. Calculated by Burchfield et al. (2006)

Local government expenditures and taxes Taken from the *City and County Data Book 2000.*

Wharton Residential Land Use Regulatory Index an aggregate measure of regulatory constraint on development (Gyourko et al., forthcoming).

Federal spending differential Dollars in federal spending to MSA excluding wages, contracts, and transfers to non-workers. Expressed as a percentage of average income (Albouy 2009a).

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TABLE A1: LIST OF METROPOLITAN AND NON-METROPOLITAN AREAS BY ESTIMATED QUALITY OF LIFE

Full Name of Metropolitan Area	Population Size	Wages	Housing Cost	Adjusted Quality of Life	Adjusted QOL Rank	Unadjusted Quality of Life	Unadjusted QOL Rank
Honolulu, HI MSA	876,156	-0.005	0.493	0.165	1	0.129	19
Santa Barbara--Santa Maria--Lompoc, CA MSA	399,347	0.108	0.665	0.158	2	0.059	90
Salinas, CA MSA	401,762	0.085	0.533	0.126	3	0.048	108
Santa Fe, NM MSA	147,635	-0.060	0.254	0.115	4	0.123	20
San Luis Obispo--Atascadero--Paso Robles, CA MSA	246,681	0.019	0.400	0.115	5	0.081	59
San Francisco--Oakland--San Jose, CA CMSA	7,039,362	0.260	0.746	0.114	6	-0.073	231
non-metropolitan areas, HI	335,651	-0.029	0.288	0.111		0.101	
San Diego, CA MSA	2,813,833	0.061	0.441	0.108	7	0.049	105
Naples, FL MSA	251,377	-0.009	0.287	0.098	8	0.080	60
Medford--Ashland, OR MSA	181,269	-0.135	0.072	0.090	9	0.153	5
non-metropolitan areas, CO	924,086	-0.065	0.173	0.088		0.108	
Barnstable--Yarmouth, MA MSA	162,582	0.011	0.295	0.086	10	0.063	83
Flagstaff, AZ--UT MSA	122,366	-0.140	0.053	0.085	11	0.153	6
Eugene--Springfield, OR MSA	322,959	-0.118	0.067	0.080	12	0.135	17
Sarasota--Bradenton, FL MSA	589,959	-0.072	0.112	0.073	13	0.100	35
Wilmington, NC MSA	233,450	-0.133	0.021	0.071	14	0.138	14
Grand Junction, CO MSA	116,255	-0.180	-0.057	0.070	15	0.165	3
Fort Walton Beach, FL MSA	170,498	-0.202	-0.108	0.067	16	0.175	1
Los Angeles--Riverside--Orange County, CA CMSA	16,373,645	0.127	0.399	0.065	17	-0.027	202
non-metropolitan areas, VT	608,387	-0.166	-0.068	0.064		0.149	
Fort Collins--Loveland, CO MSA	251,494	-0.053	0.115	0.064	18	0.082	58
Bellingham, WA MSA	166,814	-0.068	0.088	0.063	19	0.090	46
non-metropolitan areas, MT	774,080	-0.266	-0.240	0.059		0.206	
Fort Myers--Cape Coral, FL MSA	440,888	-0.106	0.014	0.058	20	0.110	30
Punta Gorda, FL MSA	141,627	-0.168	-0.083	0.058	21	0.147	10
Portland, ME MSA	243,537	-0.077	0.045	0.058	22	0.089	51
non-metropolitan areas, OR	1,194,699	-0.129	-0.022	0.057		0.124	
Asheville, NC MSA	225,965	-0.156	-0.063	0.055	23	0.141	13
Tucson, AZ MSA	843,746	-0.112	-0.003	0.054	24	0.111	28
Colorado Springs, CO MSA	516,929	-0.083	0.035	0.053	25	0.091	45
Charlottesville, VA MSA	159,576	-0.113	-0.003	0.053	26	0.112	27
Charleston--North Charleston, SC MSA	549,033	-0.094	0.012	0.050	27	0.097	40
Madison, WI MSA	426,526	-0.036	0.099	0.050	28	0.061	84
Reno, NV MSA	339,486	0.026	0.198	0.050	29	0.024	148
Seattle--Tacoma--Bremerton, WA CMSA	3,554,760	0.082	0.277	0.049	30	-0.012	185
Albuquerque, NM MSA	712,738	-0.082	0.009	0.048	31	0.084	56
Chico--Paradise, CA MSA	203,171	-0.091	0.024	0.047	32	0.097	39
Miami--Fort Lauderdale, FL CMSA	3,876,380	-0.008	0.128	0.046	33	0.040	123
Boston--Worcester--Lawrence, MA--NH--ME--CT CMSA	5,819,100	0.136	0.349	0.045	34	-0.049	219
Denver--Boulder--Greeley, CO CMSA	2,581,506	0.046	0.204	0.045	35	0.005	163
non-metropolitan areas, CA	1,249,739	-0.030	0.104	0.044		0.056	
Myrtle Beach, SC MSA	196,629	-0.168	-0.121	0.042	36	0.138	15
Portland--Salem, OR--WA CMSA	2,265,223	0.033	0.167	0.041	37	0.009	158
State College, PA MSA	135,758	-0.134	-0.073	0.040	38	0.116	24
Killeen--Temple, TX MSA	312,952	-0.232	-0.230	0.040	39	0.175	2
Redding, CA MSA	163,256	-0.096	-0.010	0.039	40	0.094	43
Gainesville, FL MSA	217,955	-0.147	-0.121	0.035	41	0.117	22
non-metropolitan areas, AZ	942,343	-0.159	-0.135	0.035		0.126	
non-metropolitan areas, RI	258,023	0.047	0.181	0.035		-0.002	
non-metropolitan areas, WA	1,063,531	-0.082	-0.021	0.034		0.076	
Bryan--College Station, TX MSA	152,415	-0.133	-0.099	0.033	42	0.108	31
New York--Northern New Jersey--Long Island, NY--NJ--CT--PA CMSA	21,199,864	0.209	0.423	0.033	43	-0.103	238
Daytona Beach, FL MSA	493,175	-0.157	-0.148	0.032	44	0.120	21
Panama City, FL MSA	148,217	-0.150	-0.141	0.031	45	0.115	25
West Palm Beach--Boca Raton, FL MSA	1,131,184	0.036	0.146	0.030	46	0.000	175
Fayetteville, NC MSA	302,963	-0.190	-0.191	0.030	47	0.142	11
Norfolk--Virginia Beach--Newport News, VA--NC MSA	1,569,541	-0.107	-0.067	0.030	48	0.090	47
Austin--San Marcos, TX MSA	1,249,763	0.017	0.116	0.029	49	0.012	152
Tallahassee, FL MSA	284,539	-0.108	-0.085	0.028	50	0.087	53
Las Cruces, NM MSA	174,682	-0.208	-0.240	0.027	51	0.148	9
Iowa City, IA MSA	111,006	-0.084	-0.051	0.027	52	0.071	71
Bloomington, IN MSA	120,563	-0.119	-0.097	0.026	53	0.095	41
Sacramento--Yolo, CA CMSA	1,796,857	0.066	0.183	0.025	54	-0.020	195
Columbia, MO MSA	135,454	-0.182	-0.199	0.025	55	0.132	18
Anchorage, AK MSA	260,283	0.070	0.184	0.024	56	-0.024	200
Fort Pierce--Port St. Lucie, FL MSA	319,426	-0.086	-0.070	0.022	57	0.069	76
non-metropolitan areas, ME	1,033,664	-0.185	-0.226	0.021		0.128	
non-metropolitan areas, MA	569,691	0.005	0.085	0.021		0.016	

TABLE A1: LIST OF METROPOLITAN AND NON-METROPOLITAN AREAS BY ESTIMATED QUALITY OF LIFE

				Adjusted		Unadjusted	
Full Name of Metropolitan Area	Population Size	Wages	Housing Cost	Quality of Life	QOL Rank	Quality of Life	QOL Rank
Savannah, GA MSA	293,000	-0.064	-0.027	0.021	58	0.057	91
Lincoln, NE MSA	250,291	-0.131	-0.148	0.021	59	0.094	42
Salt Lake City--Ogden, UT MSA	1,333,914	-0.023	0.018	0.019	60	0.028	141
Athens, GA MSA	153,444	-0.134	-0.137	0.019	61	0.099	37
non-metropolitan areas, FL	1,222,532	-0.173	-0.215	0.018		0.119	
non-metropolitan areas, NH	1,011,597	-0.022	0.018	0.018		0.027	
Phoenix--Mesa, AZ MSA	3,251,876	0.031	0.096	0.018	62	-0.007	180
New Orleans, LA MSA	1,337,726	-0.073	-0.068	0.016	63	0.056	93
non-metropolitan areas, UT	531,967	-0.132	-0.158	0.014		0.093	
Abilene, TX MSA	126,555	-0.236	-0.318	0.014	64	0.157	4
Pensacola, FL MSA	412,153	-0.155	-0.201	0.014	65	0.104	33
Provo--Orem, UT MSA	368,536	-0.053	-0.046	0.013	66	0.042	119
Tampa--St. Petersburg--Clearwater, FL MSA	2,395,997	-0.058	-0.054	0.013	67	0.044	115
Clarksville--Hopkinsville, TN--KY MSA	207,033	-0.206	-0.280	0.012	68	0.135	16
Orlando, FL MSA	1,644,561	-0.040	-0.029	0.012	69	0.033	136
non-metropolitan areas, WY	493,849	-0.193	-0.270	0.012		0.125	
Wichita Falls, TX MSA	140,518	-0.226	-0.310	0.012	70	0.148	8
Billings, MT MSA	129,352	-0.178	-0.256	0.011	71	0.114	26
non-metropolitan areas, AK	367,124	0.040	0.096	0.011		-0.016	
Raleigh--Durham--Chapel Hill, NC MSA	1,187,941	0.018	0.049	0.010	72	-0.005	177
Laredo, TX MSA	193,117	-0.220	-0.311	0.009	73	0.142	12
Boise City, ID MSA	432,345	-0.082	-0.114	0.008	74	0.054	98
non-metropolitan areas, ID	863,855	-0.177	-0.252	0.008		0.115	
Jacksonville, FL MSA	1,100,491	-0.071	-0.091	0.008	75	0.049	107
Sioux Falls, SD MSA	172,412	-0.124	-0.180	0.007	76	0.079	62
non-metropolitan areas, NM	783,050	-0.212	-0.312	0.006		0.134	
Melbourne--Titusville--Palm Bay, FL MSA	476,230	-0.107	-0.153	0.005	77	0.069	75
Fayetteville--Springdale--Rogers, AR MSA	311,121	-0.139	-0.208	0.005	78	0.087	54
Yuma, AZ MSA	160,026	-0.104	-0.148	0.004	79	0.067	77
Chicago--Gary--Kenosha, IL--IN--WI CMSA	9,157,540	0.136	0.219	0.004	80	-0.081	234
Lubbock, TX MSA	242,628	-0.162	-0.239	0.003	81	0.102	34
Springfield, MO MSA	325,721	-0.185	-0.276	0.002	82	0.116	23
Spokane, WA MSA	417,939	-0.096	-0.144	0.002	83	0.060	86
non-metropolitan areas, DE	158,149	-0.077	-0.109	0.001		0.049	
Montgomery, AL MSA	333,055	-0.120	-0.183	0.001	84	0.074	66
Cedar Rapids, IA MSA	191,701	-0.079	-0.127	0.000	85	0.047	109
Pueblo, CO MSA	141,472	-0.159	-0.246	0.000	86	0.098	38
Yuba City, CA MSA	139,149	-0.072	-0.100	-0.001	87	0.047	111
non-metropolitan areas, SD	629,811	-0.273	-0.435	-0.001		0.165	
Nashville, TN MSA	1,231,311	-0.015	-0.030	-0.001	88	0.008	161
Amarillo, TX MSA	217,858	-0.143	-0.224	-0.001	89	0.087	52
Lexington, KY MSA	479,198	-0.061	-0.102	-0.002	90	0.035	131
La Crosse, WI--MN MSA	126,838	-0.121	-0.190	-0.003	91	0.073	69
Little Rock--North Little Rock, AR MSA	583,845	-0.100	-0.174	-0.003	92	0.056	92
Oklahoma City, OK MSA	1,083,346	-0.123	-0.210	-0.003	93	0.071	72
Columbia, SC MSA	536,691	-0.072	-0.127	-0.003	94	0.041	120
Ocala, FL MSA	258,916	-0.168	-0.274	-0.003	95	0.099	36
Goldsboro, NC MSA	113,329	-0.182	-0.286	-0.003	96	0.111	29
Hickory--Morganton--Lenoir, NC MSA	341,851	-0.125	-0.204	-0.004	97	0.074	67
non-metropolitan areas, NC	2,632,956	-0.148	-0.242	-0.005		0.088	
Champaign--Urbana, IL MSA	179,669	-0.079	-0.129	-0.006	98	0.047	110
Knoxville, TN MSA	687,249	-0.113	-0.197	-0.007	99	0.064	79
Milwaukee--Racine, WI CMSA	1,689,572	0.044	0.038	-0.007	100	-0.035	208
Omaha, NE--IA MSA	716,998	-0.066	-0.140	-0.007	101	0.031	137
Springfield, MA MSA	591,932	-0.006	-0.022	-0.007	102	0.001	171
Stockton--Lodi, CA MSA	563,598	0.087	0.107	-0.008	103	-0.060	225
Fargo--Moorhead, ND--MN MSA	174,367	-0.159	-0.280	-0.008	104	0.089	50
Columbus, GA--AL MSA	274,624	-0.127	-0.213	-0.008	105	0.074	68
Providence--Fall River--Warwick, RI--MA MSA	1,188,613	0.012	-0.005	-0.008	106	-0.013	187
Biloxi--Gulfport--Pascagoula, MS MSA	363,988	-0.130	-0.230	-0.008	107	0.073	70
Mobile, AL MSA	540,258	-0.126	-0.221	-0.009	108	0.070	74
Lafayette, IN MSA	182,821	-0.067	-0.129	-0.009	109	0.035	132
Charlotte--Gastonia--Rock Hill, NC--SC MSA	1,499,293	0.014	-0.018	-0.009	110	-0.018	193
Tuscaloosa, AL MSA	164,875	-0.097	-0.180	-0.009	111	0.052	101
Green Bay, WI MSA	226,778	-0.018	-0.062	-0.009	112	0.003	168
Joplin, MO MSA	157,322	-0.254	-0.418	-0.010	113	0.150	7
Yakima, WA MSA	222,581	-0.027	-0.076	-0.010	114	0.008	160
Des Moines, IA MSA	456,022	-0.019	-0.074	-0.011	115	0.000	174

TABLE A1: LIST OF METROPOLITAN AND NON-METROPOLITAN AREAS BY ESTIMATED QUALITY OF LIFE

Full Name of Metropolitan Area	Population Size	Wages	Housing Cost	Adjusted Quality of Life	Adjusted QOL Rank	Unadjusted Quality of Life	Unadjusted QOL Rank
non-metropolitan areas, NV	285,196	0.012	-0.013	-0.011		-0.015	
Washington--Baltimore, DC--MD--VA--WV CMSA	7,608,070	0.130	0.165	-0.012	116	-0.089	235
Fresno, CA MSA	922,516	-0.017	-0.057	-0.012	117	0.002	169
Dover, DE MSA	126,697	-0.083	-0.163	-0.013	118	0.043	116
non-metropolitan areas, CT	1,350,818	0.108	0.136	-0.013		-0.074	
Tyler, TX MSA	174,706	-0.103	-0.198	-0.013	119	0.054	97
Tulsa, OK MSA	803,235	-0.080	-0.180	-0.014	120	0.035	133
Lakeland--Winter Haven, FL MSA	483,924	-0.117	-0.229	-0.014	121	0.060	89
Glens Falls, NY MSA	124,345	-0.110	-0.197	-0.015	122	0.061	85
Roanoke, VA MSA	235,932	-0.107	-0.208	-0.015	123	0.055	94
Modesto, CA MSA	446,997	0.054	0.034	-0.016	124	-0.046	218
San Antonio, TX MSA	1,592,383	-0.089	-0.187	-0.016	125	0.043	118
Cleveland--Akron, OH CMSA	2,945,831	0.012	-0.037	-0.017	126	-0.021	198
Greensboro--Winston-Salem--High Point, NC MSA	1,251,509	-0.044	-0.129	-0.018	127	0.012	153
Topeka, KS MSA	169,871	-0.139	-0.273	-0.018	128	0.071	73
Merced, CA MSA	210,554	-0.013	-0.070	-0.018	129	-0.005	176
Fort Smith, AR--OK MSA	207,290	-0.176	-0.334	-0.018	130	0.092	44
non-metropolitan areas, NE	878,760	-0.254	-0.451	-0.018		0.142	
Lancaster, PA MSA	470,658	-0.012	-0.074	-0.018	131	-0.007	179
Waterloo--Cedar Falls, IA MSA	128,012	-0.129	-0.261	-0.019	132	0.063	81
Auburn--Opelika, AL MSA	115,092	-0.126	-0.253	-0.019	133	0.063	82
Corpus Christi, TX MSA	380,783	-0.081	-0.182	-0.019	134	0.035	130
Greenville--Spartanburg--Anderson, SC MSA	962,441	-0.057	-0.154	-0.019	135	0.019	150
Appleton--Oshkosh--Neenah, WI MSA	358,365	-0.045	-0.133	-0.020	136	0.012	154
Davenport--Moline--Rock Island, IA--IL MSA	359,062	-0.079	-0.184	-0.020	137	0.033	135
non-metropolitan areas, SC	1,616,255	-0.126	-0.259	-0.020		0.061	
Louisville, KY--IN MSA	1,025,598	-0.041	-0.128	-0.020	138	0.009	159
non-metropolitan areas, KS	1,366,517	-0.227	-0.410	-0.020		0.124	
Jackson, MS MSA	440,801	-0.092	-0.212	-0.020	139	0.039	124
non-metropolitan areas, NY	1,744,930	-0.111	-0.216	-0.021		0.057	
Chattanooga, TN--GA MSA	465,161	-0.092	-0.207	-0.021	140	0.040	121
non-metropolitan areas, MO	1,798,819	-0.253	-0.451	-0.021		0.140	
Albany--Schenectady--Troy, NY MSA	875,583	-0.004	-0.062	-0.021	141	-0.011	184
Johnson City--Kingsport--Bristol, TN--VA MSA	480,091	-0.155	-0.309	-0.022	142	0.078	64
Minneapolis--St. Paul, MN--WI MSA	2,968,806	0.088	0.055	-0.023	143	-0.074	232
Las Vegas, NV--AZ MSA	1,563,282	0.088	0.066	-0.023	144	-0.072	230
Rocky Mount, NC MSA	143,026	-0.106	-0.238	-0.024	145	0.047	112
Hattiesburg, MS MSA	111,674	-0.176	-0.346	-0.024	146	0.090	48
Visalia--Tulare--Porterville, CA MSA	368,021	-0.032	-0.118	-0.024	147	0.003	167
Greenville, NC MSA	133,798	-0.079	-0.201	-0.024	148	0.029	139
Sheboygan, WI MSA	112,646	-0.062	-0.172	-0.024	149	0.019	151
non-metropolitan areas, WI	1,866,585	-0.116	-0.252	-0.025		0.053	
Sioux City, IA--NE MSA	124,130	-0.122	-0.271	-0.025	150	0.054	96
Eau Claire, WI MSA	148,337	-0.119	-0.258	-0.025	151	0.055	95
Alexandria, LA MSA	126,337	-0.167	-0.336	-0.025	152	0.083	57
Sumter, SC MSA	104,646	-0.177	-0.350	-0.026	153	0.090	49
Rochester, NY MSA	1,098,201	-0.014	-0.091	-0.026	154	-0.008	181
Baton Rouge, LA MSA	602,894	-0.043	-0.151	-0.026	155	0.005	164
Evansville--Henderson, IN--KY MSA	296,195	-0.087	-0.212	-0.026	156	0.034	134
St. Joseph, MO MSA	102,490	-0.164	-0.335	-0.026	157	0.080	61
Columbus, OH MSA	1,540,157	0.025	-0.046	-0.027	158	-0.037	213
non-metropolitan areas, AR	1,607,993	-0.226	-0.437	-0.027		0.117	
Benton Harbor, MI MSA	162,453	-0.074	-0.187	-0.027	159	0.028	142
non-metropolitan areas, VA	1,640,567	-0.157	-0.322	-0.028		0.076	
non-metropolitan areas, IA	1,863,270	-0.183	-0.374	-0.029		0.090	
Monroe, LA MSA	147,250	-0.120	-0.277	-0.029	160	0.051	102
Allentown--Bethlehem--Easton, PA MSA	637,958	0.006	-0.080	-0.029	161	-0.026	201
Shreveport--Bossier City, LA MSA	392,302	-0.113	-0.266	-0.029	162	0.046	113
Canton--Massillon, OH MSA	406,934	-0.074	-0.199	-0.029	163	0.025	145
Hartford, CT MSA	1,183,110	0.150	0.147	-0.029	164	-0.114	240
Springfield, IL MSA	201,437	-0.073	-0.194	-0.029	165	0.024	146
Kansas City, MO--KS MSA	1,776,062	0.006	-0.094	-0.030	166	-0.030	206
Lafayette, LA MSA	385,647	-0.099	-0.248	-0.030	167	0.037	128
non-metropolitan areas, MD	666,998	-0.018	-0.111	-0.030		-0.009	
Scranton--Wilkes-Barre--Hazleton, PA MSA	624,776	-0.102	-0.246	-0.031	168	0.040	122
Richmond--Petersburg, VA MSA	996,512	0.006	-0.088	-0.031	169	-0.028	203
St. Louis, MO--IL MSA	2,603,607	0.005	-0.094	-0.031	170	-0.028	205
Lynchburg, VA MSA	214,911	-0.134	-0.297	-0.031	171	0.060	87

TABLE A1: LIST OF METROPOLITAN AND NON-METROPOLITAN AREAS BY ESTIMATED QUALITY OF LIFE

Full Name of Metropolitan Area	Population Size	Wages	Housing Cost	Adjusted Quality of Life	Adjusted QOL Rank	Unadjusted Quality of Life	Unadjusted QOL Rank
Dayton--Springfield, OH MSA	950,558	-0.018	-0.124	-0.031	172	-0.013	186
Birmingham, AL MSA	921,106	-0.008	-0.117	-0.032	173	-0.021	197
El Paso, TX MSA	679,622	-0.137	-0.308	-0.032	174	0.060	88
Atlanta, GA MSA	4,112,198	0.078	0.016	-0.032	175	-0.074	233
non-metropolitan areas, OK	1,862,951	-0.243	-0.479	-0.033		0.124	
Dallas--Fort Worth, TX CMSA	5,221,801	0.071	0.009	-0.033	176	-0.069	229
Harrisburg--Lebanon--Carlisle, PA MSA	629,401	-0.007	-0.113	-0.033	177	-0.021	199
Dothan, AL MSA	137,916	-0.180	-0.380	-0.033	178	0.085	55
Sharon, PA MSA	120,293	-0.147	-0.325	-0.034	179	0.066	78
Muncie, IN MSA	118,769	-0.111	-0.274	-0.035	180	0.043	117
Williamsport, PA MSA	120,044	-0.121	-0.288	-0.035	181	0.049	106
non-metropolitan areas, ND	521,239	-0.250	-0.502	-0.035		0.124	
non-metropolitan areas, TN	2,123,330	-0.181	-0.393	-0.036		0.083	
Longview--Marshall, TX MSA	208,780	-0.126	-0.305	-0.036	182	0.050	104
Erie, PA MSA	280,843	-0.105	-0.269	-0.036	183	0.038	127
Philadelphia--Wilmington--Atlantic City, PA--NJ--DE--MD CMSA	6,188,463	0.117	0.068	-0.036	184	-0.100	237
Waco, TX MSA	213,517	-0.107	-0.278	-0.037	185	0.038	126
Detroit--Ann Arbor--Flint, MI CMSA	5,456,428	0.134	0.089	-0.037	186	-0.112	239
Indianapolis, IN MSA	1,607,486	0.019	-0.090	-0.038	187	-0.041	215
Pittsburgh, PA MSA	2,358,695	-0.037	-0.171	-0.038	188	-0.006	178
Toledo, OH MSA	618,203	-0.024	-0.153	-0.038	189	-0.014	188
non-metropolitan areas, GA	2,744,802	-0.124	-0.303	-0.039		0.048	
non-metropolitan areas, TX	4,030,376	-0.186	-0.406	-0.039		0.085	
Cincinnati--Hamilton, OH--KY--IN CMSA	1,979,202	0.041	-0.064	-0.039	190	-0.057	223
Florence, AL MSA	142,950	-0.136	-0.334	-0.040	191	0.052	100
Brownsville--Harlingen--San Benito, TX MSA	335,227	-0.223	-0.469	-0.041	192	0.106	32
York, PA MSA	381,751	-0.024	-0.162	-0.041	193	-0.017	191
South Bend, IN MSA	265,559	-0.058	-0.219	-0.042	194	0.003	166
Lansing--East Lansing, MI MSA	447,728	0.005	-0.119	-0.043	195	-0.035	210
non-metropolitan areas, MN	1,565,030	-0.157	-0.364	-0.043		0.066	
Memphis, TN--AR--MS MSA	1,135,614	0.023	-0.104	-0.044	196	-0.049	220
Grand Rapids--Muskegon--Holland, MI MSA	1,088,514	0.006	-0.121	-0.044	197	-0.036	212
Wichita, KS MSA	545,220	-0.063	-0.245	-0.044	198	0.002	170
Augusta--Aiken, GA--SC MSA	477,441	-0.072	-0.249	-0.044	199	0.010	156
Buffalo--Niagara Falls, NY MSA	1,170,111	-0.027	-0.170	-0.045	200	-0.016	190
Janesville--Beloit, WI MSA	152,307	-0.002	-0.151	-0.045	201	-0.036	211
Wausau, WI MSA	125,834	-0.074	-0.257	-0.046	202	0.010	157
Binghamton, NY MSA	252,320	-0.109	-0.295	-0.047	203	0.035	129
Jackson, TN MSA	107,377	-0.079	-0.273	-0.048	204	0.011	155
Anniston, AL MSA	112,249	-0.181	-0.427	-0.048	205	0.074	65
Houma, LA MSA	194,477	-0.093	-0.296	-0.048	206	0.019	149
Mansfield, OH MSA	175,818	-0.101	-0.299	-0.049	207	0.026	143
Odessa--Midland, TX MSA	237,132	-0.125	-0.343	-0.049	208	0.039	125
Richland--Kennewick--Pasco, WA MSA	191,822	0.033	-0.104	-0.049	209	-0.059	224
St. Cloud, MN MSA	167,392	-0.101	-0.300	-0.049	210	0.026	144
non-metropolitan areas, MI	2,178,963	-0.073	-0.254	-0.050		0.009	
Altoona, PA MSA	129,144	-0.146	-0.372	-0.050	211	0.053	99
Reading, PA MSA	373,638	0.000	-0.161	-0.052	212	-0.040	214
Youngstown--Warren, OH MSA	594,746	-0.075	-0.273	-0.052	213	0.007	162
Kalamazoo--Battle Creek, MI MSA	452,851	-0.018	-0.185	-0.053	214	-0.028	204
non-metropolitan areas, PA	2,023,193	-0.129	-0.360	-0.054		0.039	
Huntsville, AL MSA	342,376	-0.038	-0.234	-0.055	215	-0.020	194
non-metropolitan areas, IN	1,791,003	-0.096	-0.316	-0.055		0.017	
Danville, VA MSA	110,156	-0.151	-0.399	-0.056	216	0.051	103
non-metropolitan areas, IL	2,202,549	-0.135	-0.369	-0.056		0.042	
non-metropolitan areas, WV	1,809,034	-0.172	-0.444	-0.056		0.061	
Utica--Rome, NY MSA	299,896	-0.113	-0.333	-0.057	217	0.030	138
non-metropolitan areas, OH	2,548,986	-0.099	-0.323	-0.057		0.018	
Bakersfield, CA MSA	661,645	0.026	-0.141	-0.058	218	-0.062	227
Macon, GA MSA	322,549	-0.058	-0.267	-0.058	219	-0.009	182
Fort Wayne, IN MSA	502,141	-0.048	-0.255	-0.059	220	-0.016	189
Houston--Galveston--Brazoria, TX CMSA	4,669,571	0.072	-0.075	-0.060	221	-0.091	236
Albany, GA MSA	120,822	-0.081	-0.307	-0.060	222	0.004	165
Terre Haute, IN MSA	149,192	-0.120	-0.367	-0.060	223	0.029	140
Rochester, MN MSA	124,277	0.022	-0.159	-0.060	224	-0.061	226
Lake Charles, LA MSA	183,577	-0.062	-0.286	-0.060	225	-0.010	183
Syracuse, NY MSA	732,117	-0.038	-0.234	-0.061	226	-0.021	196
non-metropolitan areas, LA	1,415,540	-0.149	-0.420	-0.061		0.044	

TABLE A1: LIST OF METROPOLITAN AND NON-METROPOLITAN AREAS BY ESTIMATED QUALITY OF LIFE

				Adjusted		Unadjusted	
Full Name of Metropolitan Area	Population Size	Wages	Housing Cost	Quality of Life	QOL Rank	Quality of Life	QOL Rank
non-metropolitan areas, MS	1,869,256	-0.196	-0.496	-0.062		0.072	
non-metropolitan areas, KY	2,828,647	-0.154	-0.432	-0.063		0.046	
Peoria--Pekin, IL MSA	347,387	-0.020	-0.220	-0.063	227	-0.035	209
Jamestown, NY MSA	139,750	-0.143	-0.394	-0.063	228	0.044	114
Johnstown, PA MSA	232,621	-0.181	-0.470	-0.064	229	0.063	80
Bloomington--Normal, IL MSA	150,433	0.029	-0.152	-0.064	230	-0.067	228
Duluth--Superior, MN--WI MSA	243,815	-0.082	-0.323	-0.065	231	0.001	172
Saginaw--Bay City--Midland, MI MSA	403,070	-0.010	-0.213	-0.066	232	-0.043	217
Lima, OH MSA	155,084	-0.082	-0.326	-0.066	233	0.001	173
Jackson, MI MSA	158,422	-0.015	-0.227	-0.068	234	-0.042	216
non-metropolitan areas, AL	1,504,381	-0.166	-0.469	-0.068		0.049	
Rockford, IL MSA	371,236	0.004	-0.201	-0.069	235	-0.055	222
Decatur, AL MSA	145,867	-0.061	-0.312	-0.069	236	-0.017	192
McAllen--Edinburg--Mission, TX MSA	569,463	-0.216	-0.548	-0.069	237	0.079	63
Gadsden, AL MSA	103,459	-0.131	-0.425	-0.072	238	0.024	147
Decatur, IL MSA	114,706	-0.055	-0.343	-0.086	239	-0.031	207
Beaumont--Port Arthur, TX MSA	385,090	-0.034	-0.343	-0.093	240	-0.052	221
Kokomo, IN MSA	101,541	0.073	-0.239	-0.111	241	-0.132	241

Populations in non-metropolitan areas are approximate.

TABLE A2: LIST OF STATES BY ESTIMATED QUALITY OF LIFE

				Adjusted		Unadjusted		Gabriel et al. (2003)	
State	Population	Wages	Housing Cost	Quality of Life	QOL Rank	Quality of Life	QOL Rank	1980 rank	1990 rank
Hawaii	1,211,717	-0.013	0.431	0.149	1	0.120	6	21	38
California	33,884,660	0.133	0.435	0.074	2	-0.025	41	39	42
Vermont	608,387	-0.166	-0.068	0.064	3	0.149	3	13	13
Colorado	4,300,832	-0.011	0.157	0.058	4	0.050	21	45	34
Montana	902,740	-0.255	-0.242	0.053	5	0.194	1	5	4
Oregon	3,424,928	-0.043	0.089	0.052	6	0.065	14	24	22
Washington	5,894,780	0.030	0.166	0.039	7	0.011	31	33	41
Massachusetts	6,353,449	0.103	0.277	0.037	8	-0.034	42	29	27
New Mexico	1,818,615	-0.143	-0.119	0.035	9	0.113	8	7	14
Arizona	5,133,711	-0.030	0.036	0.028	10	0.039	26	34	20
Florida	15,986,890	-0.064	-0.019	0.027	11	0.059	18	19	10
Maine	1,275,357	-0.170	-0.188	0.026	12	0.123	5	9	9
New Hampshire	1,234,816	-0.001	0.062	0.021	13	0.017	30	20	43
Utah	2,230,835	-0.063	-0.047	0.017	14	0.051	20	46	47
New Jersey	8,416,753	0.190	0.351	0.017	15	-0.102	50	36	39
Alaska	626,187	0.051	0.128	0.016	16	-0.019	40	41	23
Wyoming	493,849	-0.193	-0.270	0.012	17	0.125	4	2	1
Idaho	1,294,016	-0.148	-0.209	0.008	18	0.096	12	4	5
New York	18,976,061	0.094	0.166	0.006	19	-0.052	46	50	50
Rhode island	1,048,463	0.022	0.049	0.005	20	-0.010	35	14	12
Connecticut	3,408,068	0.154	0.244	0.000	21	-0.093	49	32	32
South Dakota	753,887	-0.254	-0.402	0.000	22	0.154	2	1	2
North Carolina	8,047,735	-0.071	-0.115	-0.001	23	0.042	24	18	17
Nevada	2,000,306	0.064	0.079	-0.008	24	-0.045	44	11	29
South Carolina	4,013,644	-0.096	-0.177	-0.008	25	0.052	19	25	18
Virginia	7,080,588	-0.015	-0.051	-0.009	26	0.003	32	30	31
Nebraska	1,709,804	-0.188	-0.329	-0.010	27	0.106	9	8	16
District of Columbia	571,753	0.130	0.165	-0.013		-0.089			
Wisconsin	5,357,182	-0.056	-0.133	-0.015	28	0.023	29	47	45
Maryland	5,299,635	0.111	0.129	-0.015	29	-0.078	48	40	37
Arkansas	2,672,286	-0.185	-0.346	-0.017	30	0.099	10	6	3
Illinois	12,417,190	0.045	0.013	-0.019	31	-0.042	43	48	48
Iowa	2,923,345	-0.147	-0.300	-0.022	32	0.072	13	10	15
Oklahoma	3,450,058	-0.187	-0.365	-0.023	33	0.096	11	43	40
Missouri	5,595,490	-0.111	-0.245	-0.023	34	0.049	22	22	21
Tennessee	5,688,335	-0.100	-0.231	-0.024	35	0.043	23	31	28
Delaware	783,216	0.049	-0.002	-0.026	36	-0.049	45	35	30
Kansas	2,687,110	-0.139	-0.301	-0.027	37	0.064	15	12	19
Louisiana	4,469,586	-0.103	-0.251	-0.029	38	0.040	25	17	8
North Dakota	642,412	-0.234	-0.464	-0.031	39	0.118	7	15	6
Georgia	8,186,187	-0.015	-0.125	-0.033	40	-0.016	39	28	36
Texas	20,848,171	-0.034	-0.155	-0.033	41	-0.005	33	27	25
Minnesota	4,912,048	-0.026	-0.147	-0.035	42	-0.010	36	42	46
Ohio	11,353,531	-0.023	-0.148	-0.037	43	-0.014	38	38	33
Pennsylvania	12,275,624	-0.027	-0.161	-0.039	44	-0.013	37	37	35
Indiana	6,081,521	-0.039	-0.185	-0.041	45	-0.008	34	44	44
Alabama	4,446,543	-0.111	-0.309	-0.044	46	0.034	27	26	26
Michigan	9,935,711	0.034	-0.080	-0.044	47	-0.054	47	49	49
Mississippi	2,844,004	-0.164	-0.403	-0.047	48	0.063	16	3	7
Kentucky	4,040,856	-0.111	-0.321	-0.048	49	0.030	28	23	24
West Virginia	1,809,034	-0.172	-0.444	-0.056	50	0.061	17	16	11

Figure A1: Linear vs Quadratic Approximation of Quality of Life

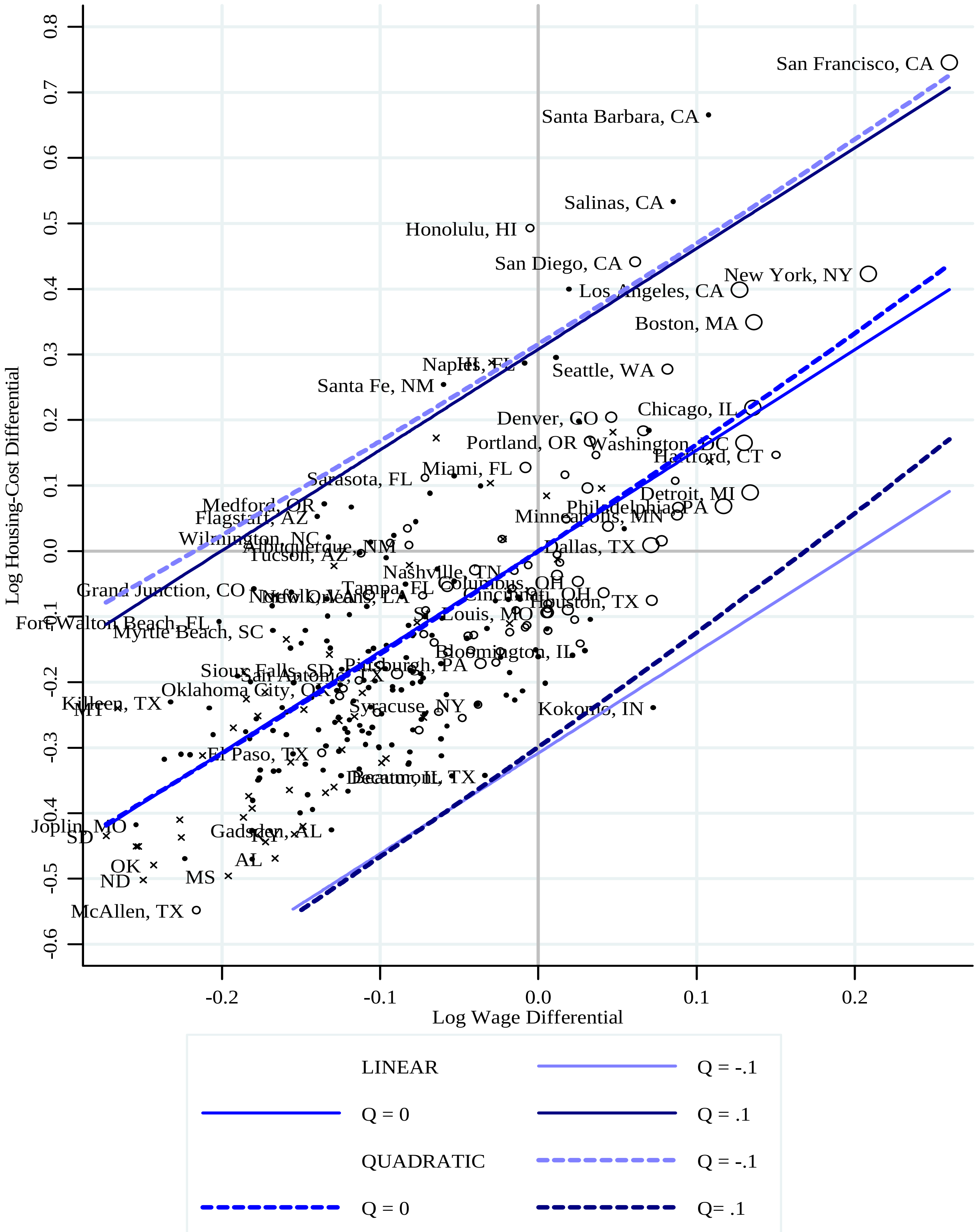

Table A2: Housing-Cost Measure versus Rent

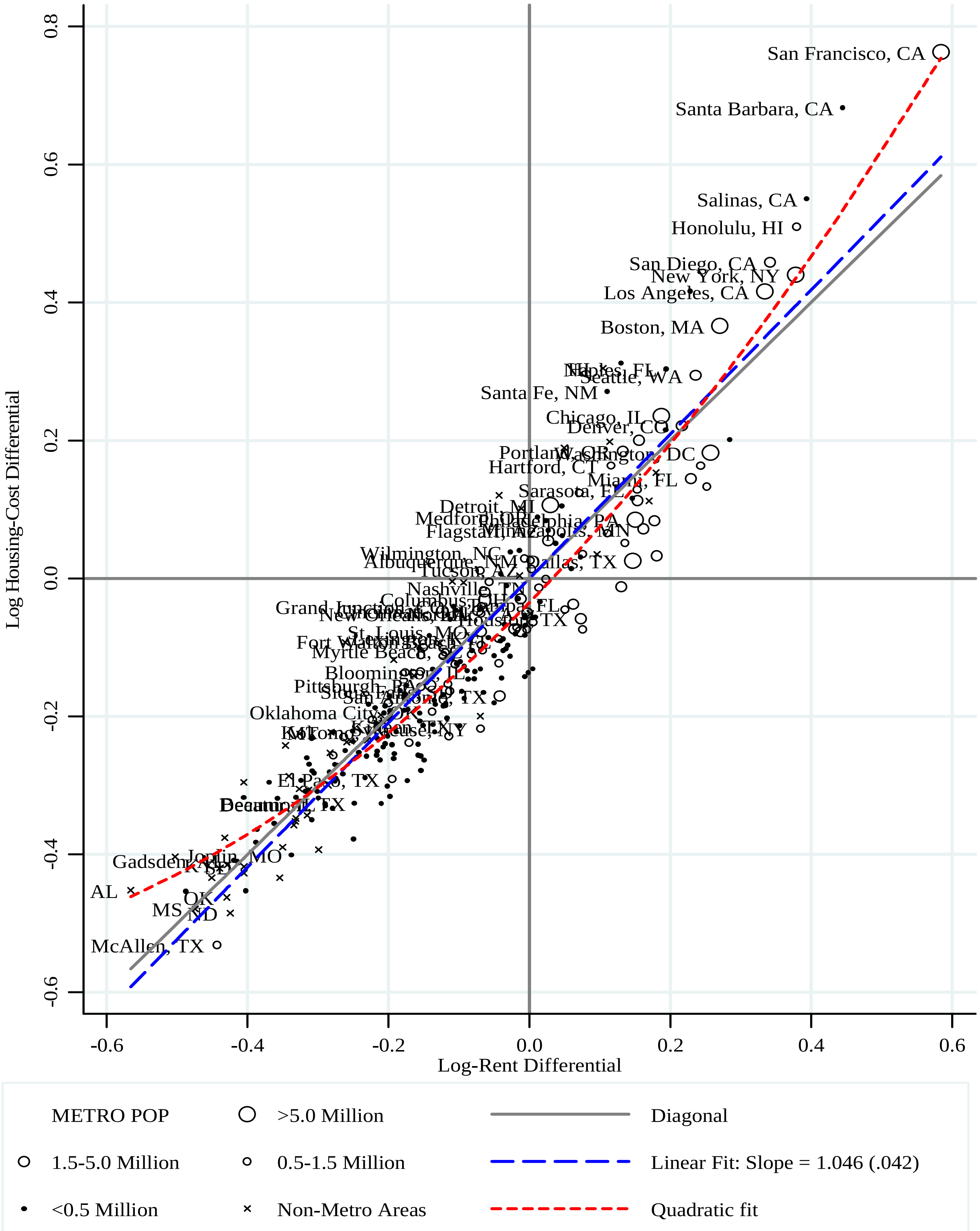

Table A3: Ownership Rates versus the Housing-Price-to-Rent Ratio